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THE ECOLOGICAL AND SOCIAL STRUCTURE OF
ALEXANDRIA, EGYPT: AN EXAMINATION OF
URBAN SUBAREA DATA, 1947 AND 1960

DISSERTATION
Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
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CHAPTER I
TOWARD A THEORY OF COMPARATIVE URBAN ECOLOGY:
FROM IDEAL-TYPES TO EMPIRICAL RESEARCH

Introduction

Sociologists, in general, have maintained an interest in the patterns of social life emerging in the city. A number of them have recently examined the impact of the city upon human ecology and social structure.¹ Park and Burgess and their colleagues and students have been instrumental in developing and popularizing a rather abstract and theoretical endeavors. They, as Sjoberg points out, drew heavily upon the writings of European sociologists such as George Simmel, Maine, Tonnies, Durkheim and Max Weber.²

In the last hundred years, confronted with the rapid urbanization and industrialization of their countries and the consequent weakening of village and rural life, European sociologists have tried to explain the cultural distinctions between cities and villages.³ Most of their early writings were aimed at describing the characteristics of European urban social structure and the condition responsible for


²Ibid., p. 150.

these developments. To these sociologists, such developments signified the passage of their countries from one type of social order to another. In their attempt to explain the patterns and processes involved in the transition from one social order to another, they labeled various kinds of social orders, of which Gemeinschaft and Gesellschaft (Community and Society) are the better known.

In their search for a theoretical orientation, early American sociologists, notably Park, Burgess, Wirth, etc., drew heavily upon these European traditions. In Chicago human ecologists found in the European typology of society, conceived in idealypical terms, a theoretical basis for the contrast between rural and urban social structure. Consequently, the Chicago school has addressed itself to an issue of central concern—namely, "What are the patterns and processes involved in the transition from a pre-industrial, or agrarian, feudal way of life to an industrial or urban order?"

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6Sjoberg, _op. cit._, p. 160.
The problem of this chapter is to review both the theoretical and empirical efforts that have been directed toward developing a theory of comparative urban ecology. Our critical evaluation will deal with those efforts that have been oriented toward the search for universal rules and patterns applicable to all cities. The main purpose of this chapter is to indicate the value of factorial research in determining the scope of the variation of social characteristics among cities of different sizes, economic structures, and cultural contexts before any universal elements of urban life can be distinguished.

In Search for Universal Rules and Patterns Applicable to All Cities

The American city, in particular, has stimulated theoretical endeavors which have helped in developing dominating theories relating to urban ecological structure. Human ecologists examining the city at a higher level of abstraction, hoped to produce a general theory of urbanization. For this reason, as Francisco Benet once noted, the rural-urban polarity was given utmost importance, to a point that it may be considered as the leitmotif of the "Chicago" school.

In their early work, Wirth and Redfield among others, have overemphasized the importance of the rural-urban distinction and the

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9 Robert Redfield, "Culture Change in Yucatan," American Anthropologist, Vol. 36, No. 1, (1934); The Folk Culture of Yucatan (Chicago,
and the folk-urban or rural-urban dichotomy became a widely accepted theory of urbanization by American scholars during the 1930's and 1940's.

Robert Redfield, working primarily in Mexico, identified what he thought were the key characteristics of the folk end of this concept, while Wirth formulated the urban end of the concept—largely on the basis of experience with American cities, in particular Chicago. In "Urbanism as a Way of Life," Wirth takes the city, characterized by size, density and heterogeneity as the key determinant of many kinds of social action. Redfield, too, utilized the city as a key variable. However, he considers heterogeneity and lack of isolation to be the city's chief characteristics. 10

The folk-urban continuum.—Redfield's scheme was designed to make contrast between rural-urban. The scheme defines an ideal type; the folk society, which is the polar opposite of urban society. 11 The contrast with a non-urban way of life is expressed in Redfield's scheme as a contrast between two polar types. In the usual formulation, as William Petersen argues, "rural-urban is more or less identified with Gemeinschaft-Gessellschaft and thus with non-industrial-industry." 12

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10 Sjoberg, op. cit., p. 160.


Redfield defines the folk society as follows:

Such a society is small, isolated, non-literate, and homogeneous, with a strong sense of group solidarity. The ways of living are conventionalized into a coherent system which we call "a culture." Behavior is traditional, spontaneous, uncritical, and personal; there is no legislation or habit of experiment and reflection for intellectual ends. Kinship, its relationships and institutions, are the type categories of experience and the familial groups is the unit of action. The sacred prevails over the secular; the economy is one of status rather than of the market. 13

This last paragraph was the central theme of Redfield's theory because he concerned himself largely with the folk pole of the continuum. 14 "Implicit in the use of this pole as an ideal type, however, is the ideal that it stands for urbanized society in general, and that Western society represents the specific case most closely approximating the polar category." 15 The rationale behind the ideal-type then, was to arrange real societies in order of the degree of resemblance to it. The conception develops that any one real society is more or less folk. 16

Redfield's typology has been accepted for some time as an analysis of the different forms of cultural integration in urban centers and rural villages, but it has proved to suffer from a shortcoming of which he is by no means aware. Redfield developed only the type of the folk

13 A quotation from Redfield, "The Folk Society," op. cit., p. 293.

14 Horace Minor, op. cit., p. 531.

15 Ibid., p. 550.

16 Philip M. Hauser, "Observations on The Urban Folk and Urban-Rural Dichotomies as Forms of Western Ethnocentrism," in Philip M. Hauser and Leo Schnore, op. cit., p. 514.
society and assigned to the urban society all those characteristics which are nonfolk-like. In other words, in Redfield's scheme, the urban society is really the nonfolk society.  

The folk-urban continuum became a widely-accepted theory of urbanization by American scholars during the 1930's and 1940's. This acceptance, however, with the increasing recognition of students, that there were many departures from reality in the folk-urban continuum, led to a literature of criticisms. Among the critics were Tax, Wirth, Oscar Lewis, Kolb, Duncan, Albert Reiss, and Philip Hauser. Most of these criticisms are classified by Horace Minor as follows:

1. The problem of lack of fit between the empirical evidence on particular societies and the nature of these societies which one might expect from the ideal-type construct.

2. The limited theoretical insight provided by the continuum.

3. The problem of definition of the characteristics of the ideal types.

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During the 1950's, Redfield reacted, with the collaboration of M.B. Singer, to his critics by extending his scheme and suggested two types of urbanization: primary and secondary urbanization. In their view of primary and secondary urbanization, they believe that this will increase our knowledge of the cultural roles of cities in the civilization which they represent. This cannot be fully understood except in relation to the entire pattern of urbanization within that civilization, i.e., the number, size, composition, distribution, duration, sequence, morphology, function, rates of growth and decline, and the relation to countryside and to each other, of the cities within a civilization.

As they continued the argument, in societies with little industrialization and a relatively low level of economic performance, the city has an influence primarily as a center of political and administrative power and place in which the cultural achievement of society

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22 This distinction is an extension of the distinction between the primary and secondary phases of the Folk transformations in Redfield's The Primitive World and Its Transformation, op. cit., p. 4.

23 Redfield and Singer, op. cit., p. 60.
are brought to their highest point of elaboration. This process was designated by Redfield and Singer as orthogenetic cultural transformation. It takes place characteristically in cities, exists in non-industrial environments. In many of these cities, new functions and new tasks have been superimposed, and side by side with them, new cities have been founded which have predominantly administrative or economic functions. These latter cities have been described by Redfield and Singer as cities of heterogenetic transformations, and they are the cities of technical order.

The dichotomy between orthogenetic and heterogenetic transformation which is implied in this scheme must be regarded as a postulate of two ideal types of urban centers, and the actual features of cities in Western countries and in Asia and Africa fall somewhere in between.

However, this distinction creates many problems because this model may not apply to many cases. For example, as Hoselitz points out, "we may obtain many possible classes into which cities may be placed. Accordingly, any one city may be placed into more than one class in the course of its history."

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24 Redfield and Singer, op. cit., p. 59.
25 Ibid., pp. 59-60.
27 Ibid., p. 190.
Thus, it is clear that the ideal types suggested by Redfield and later by Redfield and Singer, do not elaborate on many ecological characteristics, if they are applied to many of the cities in developing nations. Besides, the ideal types deal with forms, rather than with process and cannot aspire at being more than a polarity of models.  

The "Urban Ideal Type"

The second important tradition besides Redfield's contribution, is in Louis Wirth's theory "Urbanism as a Way of Life." This article distilled much of the thinking of the scholars of the city in his own generation and has provided a starting point for much work by scholars in succeeding generations. We believe that the discussion of Wirth's theory is relevant as well as important to our approach, since "Urban" ideal-type has been viewed as the opposite of the "folk" ideal-type.

In his treatment of "urbanism as a way of life," Wirth dealt with three basic concepts—size, density, and heterogeneity, which were taken to be the key features of the city. According to Wirth:

The larger, the more densely populated, and the more heterogeneous a community, the more accentuated the characteristics associated with urbanism will be...
The bonds of kinship, of neighborliness, and the

28 Francisco Benet, op. cit., p. 11.

sentiments arising out of living together for generations under a common folk tradition are likely to be absent or, at best, relatively weak. Competition and formal control mechanisms furnish the substitutes for the bonds of solidarity that are relied upon to hold a folk society together. The city is characterized by secondary rather than primary contacts. The contacts in the city may indeed be face to face, but they are nevertheless impersonal, superficial, transitory, and segmental.

These key features were then related to each other by a set of propositions, setting out the conditions under which a large, dense, heterogeneous aggregate of people might be expected to cooperate enough to maintain the complex organization of the city. As Louis Wirth puts it:

"...On the basis of the three variables, number, density of settlement, and degree of heterogeneity, it appears possible to explain the characteristics of urban life and to account for the differences of various sizes and types."

From the preceding quotations we can infer that Wirth thinks of the city as a whole, as a community, and assumes that all people who live in cities are affected by this experience in profound and similar ways, namely the weakening of kinship bonds, family life, and neighborhood, and the development of impersonality, superficiality, anonymity and transitoriness in personal relations. For Wirth, the process of

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30 From a quotation by William Petersen, op. cit., p. 434.
32 Louis Wirth, "Urbanism as a Way of Life," op. cit., p. 22.
urbanization is essentially a process of disorganization.\textsuperscript{33}

As an ideal type, Wirth's theory has been criticized for its generalizations which would hold for all cities. However, some of Wirth's deductions apply only to the industrial city.\textsuperscript{34} More crucially, some of Wirth's propositions even hardly apply to the preindustrial city, or to the metropolis in the economically less advanced area.\textsuperscript{35}


\textsuperscript{34} R.N. Morris, \textit{op. cit.}, pp. 22-25.


\textsuperscript{36} Hauser, \textit{op. cit.}, pp. 511-514.
As Hauser notes, Wirth was quite explicit, however, about the limitation of the ideal-type constructs as empirical generalizations.\(^{37}\) After an attempt to test both the "Folk-Urban" and the "Rural-Urban" dichotomies, Hauser identifies many points of deviations and concludes that:

There is evidence, by no means conclusive as yet, that both parts of these dichotomies represent compounded variables and, in fact, complex systems of variables which have yet to be unscrambled. The dichotomizations perhaps represent all too hasty efforts to synthesize and integrate what little knowledge has been acquired in empirical research. The widespread acceptance of these ideal-type constructs as generalizations without benefit of adequate research, well illustrates the dangers of catchy neologism which often get confused with knowledge.\(^{38}\)

Implicit in the foregoing discussions is the acceptance of the wholesale of idealistic definitions of the rural and urban worlds. Empirical research, however, has shown that the size or density of settlements fail to support the implicit assumptions in the Wirth-Redfield dichotomies.\(^{39}\)


\(^{38}\)Ibid., p. 514.

In addition, Richard Dewey recognizes that rural-urban ideal types have failed to make an analytical distinction between population and cultural variables and this has led to much confusion and escalation of definitions. According to Dewey, the major source of confusion is to be found in the cultural variables attached to the ideal types, while rural-urban has three population referents: density of settlement, number of inhabitants, and heterogeneity. Dewey argues that the variables usually associated with this continuum can vary, independent of size and other variables usually associated with one end or the continuum.

The demographic approach to the study of urbanization has been adopted by a number of ecologists and proved to lend itself to measurement. When human ecologists began to turn their attention to the large, densely settled, and heterogeneous cities of the East, they have found that the demographic factors of number, growth rates, density, population composition, etc., as contributing to ecological forms and social relations only after being continuously filtered through the social structure, the value system, the technology, and the economy.


In Search for Subtypes of Cities: The Case of the Preindustrial City

The new school of human ecology has, to a large degree, abandoned the search for universal rules and patterns applicable to all cities. While ecological research on American cities has revealed rather striking uniformities of ecological patterning, sufficient at least for certain tentative theories,⁴³ observations made in non-U.S. cities demonstrated significant differences.⁴⁴ Consequently, as Abu-Lughod maintains, they accept a more specific reference for their research and are attempting, at most, to generalize gradually to subtypes of cities.⁴⁵


This new shift in the ecological analysis is viewed by Sjoberg as a bridge between the older Chicago School and a highly active group of younger ecologists prominent among whom are Duncan and Schnore, and Schnore, Gibbs and Martin. Being aware of the fact that most generalizations that had ever been made about the city are being refuted in current research, human ecologists have acknowledged the need for a general theory that could anticipate differences in urban form in relation to differences in culture, social structure and level of technology. In fact, the recent contributions in the study of the city in less-advanced areas around the world by historians, as well as by economists, has facilitated such acknowledgment. The historical contribution to the study of urbanization has enabled human ecologists to use the historical evidence in order to build up, not one ideal type of urbanism, but perhaps, an entire sequence of ideal types.

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frame of reference is adopted, cities in other types of society need be represented as intermediate groups along the road or roads.\(^\text{49}\)

The discussions of this new argument are numerous and very detailed, but we shall confine ourselves to the discussion of Sjoberg's model relating to the "preindustrial city," because we believe that this concept appears to be a step forward in our attempt to look at the morphology of the developing city.

The recent description of the "preindustrial city"\(^\text{50}\) focuses on a traditional social structure in such cities, maintained by an interpenetration of kinship structure, power structure, and religion. The emphasis upon kinship is articulated in a hereditary tribal or caste system that serves to establish hierarchies of prestige and corresponding hierarchies of political and religious control.\(^\text{51}\)

Sjoberg in "The Preindustrial City: Past and Present," attempted to fit many variegated data into a single "constructed" type. He proposed that cities in nonindustrialized civilizations all belong to the same genus, that in respect to social structure, they lie in a tradition that runs back to antiquity. His hypothesis was that, in their structure or form, preindustrial cities resemble one another closely, and in turn, differ markedly from modern industrial urban centers.


Certain aspects of the spatial arrangement of preindustrial cities are described by Sjoberg in the following:

1. The internal arrangement of the preindustrial city is closely related to the city's economic and social structure. Most streets are mere passageways for people and for animals used for transport. The congested conditions, combined with limited scientific knowledge, have fostered serious sanitation problems.

2. More significant is the rigid social segregation which typically has led to the formation of "quarters" or "wards." Thus ethnic groups live in special sections. Lower-class and especially "outcast" groups live on the city's periphery. Social segregation, the limited transportation facilities, the modicum of residential mobility, and the cramped living quarters have encouraged the development of well-defined neighborhoods which are almost primarily, groups.

3. No real specialization of land use such as is functionally necessary in industrial-urban communities.

4. The "business district" does not hold the position of dominance as is the case with the industrial-urban community.\(^2\)

This attempt, however, was valuable for two reasons. First, instead of assuming that cities everywhere are the same, Sjoberg found that characteristics which made up cities found in the industrial society were in marked contrast to those found in the preindustrial city. This, of course, is an implicit attack of the folk-urban typology that conditions the thinking of many social scientists. Second, Sjoberg's view of cities as subsystems within feudal societies. For these two reasons, Sjoberg's model can be viewed as an advance toward developing a comparative theory of urban ecology.


\(^{52}\) Sjoberg, *op. cit.*, pp. 91-98.
However, the preindustrial-city model is too broad a construct to serve as a precision tool for the purposes he envisages. Accordingly, during the past five years, it has become increasingly apparent to many urban ecologists and urban geographers that Sjoberg’s model does not match the pattern of urbanization and ecological arrangements found in much of the developing cities. In addition, Sjoberg himself came to realize this in a recent article where he described the urban phenomena in the Developing World as the industrializing city—a city neither industrial nor preindustrial in his terms.

Most recent investigations on cities in developing countries have revealed that certain aspects of the spatial arrangements of preindustrial cities, described by Sjoberg, characterize some developing cities; other descriptions of the preindustrial city’s central area were found to be partially applicable. Redick found that the ecological organization of present-day Rangoon, Burma, only partially reflects the descriptions accorded the preindustrial city.


In many ways, Rangoon's stage of development tends more to resemble that of the 19th century industrial cities. In this process, as Redick contends, "it would be expected that Rangoon would come to resemble more and more the cities of the West with respect to demographic characteristics and ecological structure."

Evidently, the case of Rangoon is quite similar to many cities in the Third World, and obviously, it would be too glib to suggest that all developing or industrializing cities are entirely similar.

Toward A Theory of Comparative Urban Ecology: The Concept of "Scale" and the Role of Factorial Research

So far, we have dealt with the typology construction of urban models and their failure to stand against the realities of empirical research. Accordingly, new approaches of urban ecology have developed because of a growing dissatisfaction with these earlier conceptualizations. A general consensus, thus, has prevailed among most human ecologists and urban sociologists that future urban research must deal with the comparative description and analysis of urban places.

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58R. Redick, op. cit., p. 41.
When human ecologists examined ecological patterns in a variety of cities which have preindustrial histories, they have found, not only that these cities present many points of ecological contrasts to industrial cities, but also differ among themselves in terms of some facets of their ecological and social structure. The empirical findings produced through a vast number of empirical researches have raised several questions on the relationships of ecological patterns to the social and technological base on which these cities rest. The city should no longer be viewed or conceptualized in isolation from the most of the society.

Social area analysis seems to be one of the more promising approaches to urban ecology which postulates that the city is molded by the economic and social changes that are taking place in society.

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This approach rests upon certain broad conceptual notions or postulates concerning the changing character of modern society. The formulation of these postulates is described and outlined by Shevky and Bell in Table 1. Their typology is a classification schema designed to categorize census tract populations in terms of three basic factors—social rank, urbanization, and segregation. Each census tract population was given three scores, one for each of the indexes of the factors and then the tract populations with similar configurations of scores on the three indexes were grouped together into larger units called "social areas." Then a theoretical attempt was made by sketching out the reasoning which led to the development of the constructs of social rank, urbanization, and segregation as basic features in the social differentiation of the contemporary city.

This attempt is viewed by Udry as a way to coordinate the axes of differentiation of social areas from one another with the basic variables as a theory of the developmental process of a complex society.

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63 Ibid.

Table 1 presents in schematic form the basic arguments for developing those three constructs. Following the theoretical reasoning underlying this schematic form, Shevky and Bell argue that as society increases in "scale," three correlated processes are asserted to occur. These three correlated processes are outlined by Udry in the following:

1. The occupational structure will shift from a large proportion in manual occupations to a large proportion in clerical, supervisory, and management occupations. This shift will be reflected in general improvement in economic status and social rank, and can be measured for any census tract by an index combining measures for that tract of occupational, educational level, and amount of rent.

2. Industry will shift from primary to secondary to tertiary production, which is accompanied by urbanization (people concentrated in cities), with consequent changes in family life, which can be measured in any census tract by an index combining measures for that tract of fertility, women in the labor force, and single-family dwelling units.

3. Social organization will become increasingly complex, and this will be reflected in more complex and differentiated units. This results in particular, in the segregation and nationality groups, and can be measured for any census tract by an index of ethnic-racial segregation.65

By factor analysis Wendell Bell66 has shown that these three constructs are necessary to account for the observed social differentiation between urban subpopulations and that the indexes which measure

65Ibid., pp. 403-405.
## TABLE 1. Social Area Analysis: Steps in Construct Formation and Index Construction

<table>
<thead>
<tr>
<th>Postulates Concerning Industrial Society (Aspects of Increasing Scale)</th>
<th>Statistics of Trends</th>
<th>Changes in the Structure of a Given Social System</th>
<th>Sample Statistics (Related to the Constructs)</th>
<th>Derived Measures (From Col. 5)</th>
<th>Derived Measures (From Col. 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing distribution of skills:</td>
<td>Changing distribution of skills:</td>
<td>Changes in the arrangement of occupations based on function</td>
<td>Social Rank (economic status)</td>
<td>Years of schooling</td>
<td>Occupation Schooling Rent</td>
</tr>
<tr>
<td>Lessening importance of manual productive operations - growing importance of clerical, supervisory, management operations</td>
<td>Lessening importance of manual productive operations - growing importance of clerical, supervisory, management operations</td>
<td>Changes in the ways of living - movement of women into urban occupations - spread of alternative family patterns</td>
<td>Urbanization (family status)</td>
<td>Employment status</td>
<td>Class of worker</td>
</tr>
<tr>
<td>Changing structure of productive activity:</td>
<td>Changing structure of productive activity:</td>
<td>Changes in the ways of living - movement of women into urban occupations - spread of alternative family patterns</td>
<td>Urbanization (family status)</td>
<td>Major occupation group</td>
<td>Major occupation group</td>
</tr>
<tr>
<td>Complexity of organization</td>
<td>Lessening importance of primary production - growing importance of relations centered in cities - lessening importance of the household as economic unit</td>
<td>Lessening importance of primary production - growing importance of relations centered in cities - lessening importance of the household as economic unit</td>
<td>Lessening importance of primary production - growing importance of relations centered in cities - lessening importance of the household as economic unit</td>
<td>Value of home</td>
<td>Race and nativity</td>
</tr>
<tr>
<td>Changing composition of population:</td>
<td>Increasing movement - alterations in age and sex distribution - increasing diversity</td>
<td>Increasing movement - alterations in age and sex distribution - increasing diversity</td>
<td>Increasing movement - alterations in age and sex distribution - increasing diversity</td>
<td>Rent by dwelling unit</td>
<td>Racial and national groups in relative isolation</td>
</tr>
<tr>
<td>Race and nativity</td>
<td>Race and nativity</td>
<td>Race and nativity</td>
<td>Race and nativity</td>
<td>Persons per room</td>
<td>Race and nativity</td>
</tr>
<tr>
<td>Segregation (ethnic status)</td>
<td>Segregation (ethnic status)</td>
<td>Segregation (ethnic status)</td>
<td>Segregation (ethnic status)</td>
<td>Race and nativity</td>
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<tr>
<td>Race and nativity</td>
<td>Race and nativity</td>
<td>Race and nativity</td>
<td>Race and nativity</td>
<td>Citizenship</td>
<td>Segregation (ethnic status)</td>
</tr>
</tbody>
</table>

Source: Shevky and Bell, *Social Area Analysis*, op. cit., p. 4.
the constructs are unidimensional measuring instruments. Tryon has also shown that the constructs are adequate, as well as necessary, to account for most of the observed variation between census tract populations. Other researchers, like Van Arsdol, Camilleri, and Schmid have concluded from their studies, using this model, that the model has proved its use in the design and analysis of urban sub-area field studies. While they emphasized, however, that their study has tested the general empirical validity of the Shevky indexes, they were only concerned with the problem of verification, but not with the overall Shevky theory.

Social area analysis has had subsequent application in most parts of the world, with special emphasis on the United States and Northwestern Europe. However, it has not avoided severe criticism


on empirical as well as theoretical grounds. Generally speaking, most criticisms have been directed toward the operational characteristics of the technique and the way in which areal data are used.

Recently, Scott Greer in his book, The Emerging City, has attempted to correlate Shevky's concept of social space and the classic notions of ecological space. Greer's attempt can be viewed as a wrapping effort of what has been called the "theory of increasing societal scale."

Schwirian provides a summary of descriptions of the empirical utility of this theory as follows:

...as the degree of modernization within a society increases, so too does the differentiation of the social system and the spatial segregation of population types. In low-scale societies there is sufficiently high correlations among the variables of social rank, familism, and ethnicity to prevent factorial separation of them, while in large scale societies the correlations among the variables are reduced sufficiently to permit the separation of social rank, familism, and ethnicity. Accordingly, it is inferred that as the scale of society changes, so too does the degree of factor separation.

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While the empirical attempts to test this theory on cities in developing nations, as well as cities in technologically less advanced areas are rare, researchers seem to have viewed the work of social area analysts favorably. In a review of the social area technique, Murdie and others have concluded that:

The general significance and utility of the social area typology can only be established by an extension of comparative studies, but it is readily apparent that the technique represents one of the most promising attempts yet available to provide a coherent and logically demonstrable frame for an analysis of urban social structure.74

Although the operational procedure of social area analysis per se automatically yields three indicies, frequently these same basic dimensions are revealed when factor analysis and related techniques are applied.75 Generally, however, additional dimensions are extracted where a wider range of variables is used than was originally suggested. Accordingly, one of the major outcomes of the application of this technique on non-U.S. cities is that the existence of the constructs should be left as an empirical question to be determined by the patterns in the variables, rather than one to be assumed to be correct a priori.76


76 Berry and Rees, op. cit., p. 458.
Thus, what is now being called "factorial ecology" is just an outgrowth of social area analysis. Schwirian, however, notes basic differences between social area analysis and factorial ecology. Factorial ecology is more inductive and includes a wider range of variables than does social area analysis, although the social area analyses are usually included. 77

Working toward developing a theory of comparative urban ecology, recent investigators argue that the formalization induced by the factorial research might be useful in developing a scale of urban development from pre-to-post industrial forms. 78 Such argument is based upon the fact that the factorial ecology, specifically social area analysis, has tied explanations of urban ecological structure to a much more specific theory of social change. 79

While empirical attempts to test this theory on cities in developing nations are not common, recent investigations in Calcutta, Cairo, and Accra reveal an interpenetration of preindustrial and industrial ecological components, consistent with the notion that these cities are in some transitional developmental stage.

77 K. Schwirian, op. cit., p. 15.
79 Schwirian, op. cit., p. 16.
Of special importance for ecological consideration is the suggestion that these different interpenetrations of preindustrial and industrial ecological components leads to different ecologies. The next step that is called for is detailed analysis of cities themselves from different parts of the world and place them on a scale of societal differentiation, or urban development, as Berry and Rees like to call it. There is no doubt that differences do exist between such cities but the need is to determine the framework within which those differences systematically appear.

Generalizing, we might argue that the developing city is a class of urban phenomenon, having special characteristics that distinguish it from both the industrial city and the prindustrial city. In order to understand the specific features of these characteristics, let us transfer the notion of scale of society to the following typology which reveals the ecological position of the city in non-technological societies and technologically advanced societies.

![Diagram of the City in Less-Technologically Advanced and in Technologically-Advanced Societies](image-url)
The typology presented here recognizes two basic dimensions: population size, and level of technology. The city found in the first category is the city of historic Europe or the preindustrial city as has been recognized before by many scholars, such as Weber, and recently by Sjoberg in *The Preindustrial City*. The city found in the second category is what we like to call the Developing City, or, the Industrializing City as Sjoberg likes to call it. The city found in the third category is the Industrial City (or U.S. Cities) with its ecological configurations as it has been recognized by most scholars.

However, the evolutionary sequence that has been roughly sketched here is far from complete. For one thing, it requires more attention to three basic factors:

1. Differences in Urban Function. While U.S. cities are commercial-industrial centers, many of the non-Western cities are primarily, or were at the time of location, primarily administrative centers. Thus, difference in primary function resulted in different land-use patterns and differential population distribution within the city.

2. Differences in Level of Transportation and Transportation Ownership Patterns. Accordingly, the spread of the population in urban space is a direct function of mode of transportation and access to transportation of large segments of the population. In countries with a more restrictive transportation pattern as compared to that of the U.S., different forces work to sort the population, thereby producing a different spatial pattern.

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81 Sjoberg, "Cities in Developing and in Industrial Societies," *op. cit.*, pp. 220-228.
3. Level of Technology at the Time of City Location.

Implied in this notion are two ideas. First, that the ecological pattern for a given city is largely determined by existing modes of transportation. And second, that once such patterns are established there is enormous inertia to their change. Change when it comes, in most cases, is slow, disjunctive, disrupted, and piecemeal.82

Also, it should be noted that this typology is intended to suggest that the developing city is not a fixed and immutable stage in cities of the Third World. Schnore has offered a suggestive set of speculations concerning current and future developments of the industrializing city in Latin America.83 As Schnore suggests, there might well be a sequential pattern of ecological change as societies modernize. Schwirian provides us with a descriptive summary of Schnore's speculations:

...In the early pattern of city development, the "inverse gradient" characterizes the city in which the affluent population lives near the city's center and the lesser monied live toward the periphery. With growth, modernization, and aging, the central portions of the city become less attractive residentially and the upper class migrates toward the periphery. The vacated areas in the inner portions of the city become the targets for those urbanites who cannot survive in the stiffer competition for fringe housing.84

In the present study we shall attempt to present a detailed case study of the city of Alexandria as a developing city, with the hope that our analysis would be of some help in developing a more inclusive theory of comparative urban ecology. Thus, our analysis of

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84 Schwirian, op. cit., p. 15
the ecological structure of the City of Alexandria should be viewed as an attempt to present an extensive analysis dealing with spatial, social, and residential structures. The analysis should delineate the distinctive aspects of the class structure of the developing city. This class structure, we believe, does not completely resemble either the class structure of a preindustrial city, or that of an industrial city.

The analysis of the developing city should project those ecological characteristics which appear to suggest that the developing city is in a transitional stage, or midway between what has been suggested before as a "rural-urban" dichotomy.
A number of research trends have been identified in current ecological research with relation to city urban structure. The first trend deals with the analytical convergence of gradient, sector, and factor analytic models which are being used in current research in a complementary fashion. Recent investigators have used the factor analysis technique to identify the basic dimensions of urban organization, and the gradient and sector models to ascertain the spatial differentiation of these dimensions. Most of the studies of this kind have attempted to test Burgess' concentric zone and Hoyt's sector hypotheses of urban residential structure, using the structure dimensions suggested by Shevky and Bell.

The second trend attempts to relate urban ecological differentiation to theories of societal development such as the theory of "increasing scale of society" which, recently, was outlined by Scott Greer in his book *The Emerging City*. Frequently, factorial ecology, as an empirical method, is being used by human ecologists. This method

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1 Kent Schwirian, *op. cit.*, pp. 1-3.

has enabled many sociologists to conduct cross-sectional comparisons of cities in different societies, with the hope of producing a comparative theory of urban ecology, which takes into account the different ecologies of preindustrial, industrial, and post-industrial societies. 3

Our study is an attempt to extend this latter cross-cultural research by presenting "a case study" of Alexandria, Egypt, using enumeration district data from the 1947 and 1960 Census of Population. This attempt deals with two major problems:

1. The factor structure of the City of Alexandria and change analysis for 1947 and 1960.

2. An ecological analysis of the residential patterns of the city's major status groups by occupation, education, and religion.

In this paper, we propose the use of a combined aggregative method to analyze the ecological structure of the city and to point out its particular qualities. In doing so, our discussions will be organized around three major areas of investigation:

1. The identification of the factor structures of the city for 1947 and 1960, using the factor-analysis technique and the change analysis between both years.

2. The extent to which the various status groups are residentially segregated from each other.

3B. Berry and P.H. Rees, ibid., p. 445.
3. The areal distribution of these status groups and their migration patterns between 1947 and 1960.

Our selection of the city of Alexandria is promoted by the following considerations: First, the study of Cairo by Abu-Lughod has been cited in the literature as an example to indicate that the degree of social differentiation in the U.A.R.'s total society is less than that in the United States. While it is true that, "if a city does not reflect the ecological pattern of the industrial city then it is not likely that the lesser cities do," this conclusion, however, raises an empirical question as, in effect: To what extent would the same finding derived from one primate city be generalized to another primate city in the same society? Our study will partially address itself to answer this question. Second, while both Cairo and Alexandria are cosmopolitan centers, as well as nexi of nation-wide coordination and service, Alexandria differs from Cairo in terms of its location, and its ethnic composition. In addition to these,

5 Berry and Rees, op. cit., p. 467; Schirian, op. cit., p. 26.
6 Schirian, ibid., p. 27.
Alexandria as a city is associated with the port function, by which larger overseas hinterlands have been tied in with it for several decades. Such a function may stimulate a pattern of urban growth quite different from that of Cairo. It is our expectation, then, that the factor structure of Alexandria would not be identical to that of Cairo. Third, data for the city's census tracts are available for 1947 and 1960 and comparable variables similar to those employed by Abu-Lughod (1969) for Cairo can be selected for purposes of comparisons between the two cities.

Current Methods and Analytic Procedures

A number of methods have been adopted by human ecologists which are presently being applied to our specific problem, that of analyzing the ecological structure of Alexandria. These methods will be discussed in this chapter with the idea of presenting their potential usefulness in cross-cultural investigation.

Our discussion will be confined to the following methods and approaches:

1. The social area analysis approach using the factor analytical technique and social area change model.
2. Indexes of residential segregation and centralization.
3. Areal distribution of status groups and the current application of centrographic measures.
Application of Factor Analysis and Social Area Change Model

Data preparation. The analysis contains a set of variables all related to the ecological and demographic structure of Alexandria. The variables which are selected for final analysis are those employed by Abu-Lughod in her study of Cairo (1966) and can be replicated for the present study.

While the indices specified by the social area analysis model could not be formed easily from the Egyptian Census, Abu-Lughod, however, successfully made an attempt to find substitute variables unique to data inputs for an Egyptian city such as Cairo.

After examining the available census information, Abu-Lughod suggested thirteen indexes which are replicated here. The comparability of census information for Cairo and Alexandria makes such replication possible. The thirteen indexes are grouped in the following four dimensions.

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9 The study of Cairo by Abu-Lughod indicates that the Egyptian Census lacks some information similar to those required by the social area model. For example, information on the type of dwelling units is not presented. In addition, information on occupation, which requires a breakdown between manual and non-manual employment, is arranged not by skills, but by industry group of the labor force data cross-tabulated by census tracts. See Abu-Lughod, The Ecology of Cairo, Egypt, op. cit., pp. 154-164.
Demographic Dimension

1. Density\(^{11}\) = Persons per square kilometer

2. Sex-ratio ages 15-49

\[ = \frac{\text{number of males (15-49) in Tract}}{\text{women (15-49)}} \times 100 \]

Family Characteristics

This dimension is obtained by calculating: fertility ratio, percentage of females never-married, percentage of males never-married, and percentage of married females now divorced. These indices were suggested by Abu-Lughod to summarize the nature of family life in various quarters of the city.

3. Fertility ratio = \(\frac{\text{children under 5 years}}{\text{women (15-49)}} \times 1000\)

4. Ratio of females never married

\[ = \frac{\text{never-married females 16+}}{\text{number of married females 16+}} \times 100 \]

5. Ratio of males never married

\[ = \frac{\text{never-married males 18+}}{\text{number of married males 18+}} \times 100 \]

6. Ratio of divorced females

\[ = \frac{\text{number of divorced females 16+}}{\text{number of married women}} \times 100 \]

Two variables are suggested to measure the demographic structure of each census tract: Density and Sex Ratio.

\(^{10}\)Information on size of tract was available in 1947 Census but not in the 1960 Census. The density for 1960 was obtained from several field-study monographs on the City's major districts published by the High Institute for Social Work, Alexandria.

\(^{11}\)Information on size of tract was available in 1947 Census but not in the 1960 Census. The density for 1960 was obtained from several field-study monographs on the City's major districts published by the High Institute for Social Work, Alexandria.
As we have mentioned earlier, Abu-Lughod was confronted with a problem when she attempted to use occupation as one major component of Shevky's social rank index. Other variables, however, were found to be sensitive indicators for social rank in the Egyptian society. For example, male and female literacy ratios were devised as substitute variables and this was viewed by Abu-Lughod as "a partial solution," given the high correlation between literacy and occupation, which have been confirmed in another study in Cairo. 13

7. Persons per Room (P.P.R.)

\[ \text{Persons per Room (P.P.R.)} = \frac{\text{No. of Residents}}{\text{No. of Rooms}} \]

8. Ratio of Literate Females

\[ \text{Ratio of Literate Females} = \frac{\text{No. of females 10+ able to read, write}}{\text{No. of females reporting literacy status}} \times 100 \]

9. Ratio of Literate Males

\[ \text{Ratio of Literate Males} = \frac{\text{No. of males 10+ able to read, write}}{\text{No. of males reporting literacy status}} \times 100 \]

10. Ratio of Females in School

\[ \text{Ratio of Females in School} = \frac{\text{Females 6+ enrolled in school}}{\text{Females between 6-19}} \times 100 \]

11. Ratio of Employed Females

\[ \text{Ratio of Employed Females} = \frac{\text{Females 6+ reporting employment}}{\text{Number of females}} \times 100 \]

12. Handicapped Rate

\[ \text{Handicapped Rate} = \frac{\text{No. of persons with disabilities}}{\text{No. of inhabitants}} \times 1000 \]

13. Male Unemployment Rate

\[ \text{Male Unemployment Rate} = \frac{\text{No. of unemployed males 6+}}{\text{No. of employed males 6+}} \times 100 \]

**Ethnic Identification**

14. Percentage of Muslims

\[ \text{Percentage of Muslims} = \frac{\text{Number of Muslims}}{\text{No. of Residents}} \times 100 \]

Variables 10 and 11 will be grouped together since information of females enrolled in school is only available for 1947, while information on employed women only appears for 1960. No measure of school enrollment could be computed for 1960, due to the absence of data.\(^\text{14}\)

The data for the indexes are from the 1947\(^\text{15}\) and 1960\(^\text{16}\) Egyptian Census figures. These demographic and socio-economic characteristics were made up of proportions and ratios. While it would have been desirable to use a great many more variables, the number was limited to thirteen because of the lack of comparable information for both years.\(^\text{17}\)


\(^{17}\)For example, information on national origin and foreign-born inhabitants by census tract was only available in the 1947 Census. For 1960, such information appeared cross-tabulated with other variables such as education and occupation but only for the major districts.
Selection of the census tracts.—Both factor and change analyses use the census tract as a basic "unit of analysis." Observations consist of 170 census tracts; 85 census tracts for each year. The selection of the census tracts was not easy, due to the fact that the actual boundaries of the city had been changed between 1947 and 1960. In 1947, the city was divided into 96 census tracts, which were distributed among ten administrative districts. In 1960, the city was divided into 116 census tracts and a number of changes had occurred due to the physical expansion of the city. First, a large district was attached to the city, el Montazah, which was located in the geographical boundaries of the Governorate of el Beheira in the northwestern section of the Delta. This new district mainly consists of most of the southeast sector of the city, where many satellite agricultural communities are located. A number of census tracts which were located within the boundaries of el-Raml District in the northeastern section were to be located and administered within this new district in 1960. Secondly, some changes in the boundaries of tracts in the interim had occurred. Subdivisions of the 1947 tracts, which were made necessary by population increases, often resulted in such boundary changes. Thirdly, another district in the western section of the city, el Dikhaila, emerged, and an old district in the 1947 census, el Mina, had to be eliminated due to a dramatic decline in its population caused by a change in the functional specialization of this district.

18These are: el Gumruk, el Mina, el Mansheyya, Minet-al-Bassal, el Labban, Karmuz, el Attarin, Muharem Bey, Bab Shark, and el Raml.
These changes have caused us some difficulties in the selection of the census tracts. Fortunately, however, other factors facilitated the comparability of tracts between 1947 and 1960: (1) The tracts are identified by names, which, in most cases, have remained the same; (2) most of the new tracts (20 census tracts) have to be eliminated from the analysis since they are located in agricultural areas in the southeastern section of the city, and (3) minor shifts in the boundaries of tracts in the interim had actually occurred.

Our decision was, then, to retain the 1947 boundaries since the changes that occurred in the interim would not have, we believe, a dramatic effect on the functional metropolitan area as a whole.

A number of other aspects regarding the selection of the census tracts should be noted. As indicated in the study of Cairo, census tract maps were not available. Fortunately, there are a number of excellent street maps for the 1947 tract limits. These maps were invaluable, since most of the census tracts have names and in most cases, are identical to the names of the main streets in the city. In addition, a Ph.D. dissertation in Urban Geography by Abd al-Hakim, published in Arabic, identified the locations of the major districts in the city with their census tract limits and the surrounding streets.

19The same problems were faced by Abu-Lughod in her study on Cairo, due to the physical boundary changes of Cairo in 1960.


21These maps have different scales: one map published by The Survey of Egypt, 1936 (36/930), with a scale from 1-25,000 metres; a General Map of Alexandria, published by the Cairo Drafting Office (Cairo, 1949), and General Map of Alexandria (scale 1:10,000 kil.) published by the U.S. Army Map Service (Washington, D.C., 1942).
Combining the information provided by the street maps and the work done by Abd al-Hakim, we were able to locate, approximately, the boundary limits of the census tracts for the year 1947.

We were able to obtain mimeographed sheets for the street boundaries of census tracts for 1960 from the Central Agency for Mobilization and Statistics, U.A.R. In addition, The High Institute of Social Work in Alexandria had published a number of survey studies of the major districts in the city, after the establishment of a "Social Research Center" in the Institute in 1961. Most of these survey studies have dealt with a descriptive analysis of the major districts in Alexandria. Each study furnished us with a demographic description of the district according to the 1960 Census, in addition to other information regarding its location, size, and boundary limits. Attached to each report was a census tract map which identifies the street boundaries for each tract.

Despite these difficulties, problems of comparability, and the elimination of the open farm tracts in the southeastern section of the city, over 80 percent of the total number of tracts for both years were suitable for our study in all three analyses.

The Techniques of Analysis

A principal factor matrix and its loadings, which account for the common variances of the variables to be done with an orthogonal

\[ \text{Muhammad Subhi Abd al-Hakim, Madinat al Iskandariyah (The City of Alexandria) (Cairo: Misr Bookshop, 1958), in Arabic, pp. 289-294.} \]

\[ \text{See, for example, Social Research Center, The High Institute of Social Work, A Sociological Study of the City of Alexandria; District of el Attarin (Alexandria, 1964); District of Muharem Bey (Alexandria, 1965); District of Karmuz (Alexandria, 1965); District of el Labban (Alexandria, 1967); District of Bab Shark (Alexandria, 1967), and District of el Amriah (Alexandria, 1968). All are in Arabic.} \]
rotation, was used to present the configurations of variables in factor space. The present factor analysis was undertaken using the BMD03M, general principal component and an orthogonal rotation of the factor matrix.

Two basic analyses were carried out: (1) factor analysis of the thirteen variables for both years; (2) an analysis of the social area change between 1947 and 1960, as indicated by the changes in each of the thirteen variables for each of the 85 tracts.

Using factor analysis for the first problem, we are able to reduce the thirteen variables to a small number of basic factors. Accordingly, it is possible to construct a picture of the census tracts which subdivide Alexandria in terms of the socioeconomic characteristics of the tract populations.

To focus on the processes of social area change within Alexandria between 1947 and 1960, an investigation of the underlying dimensions of change should be made. In this respect, many studies which have adopted the change analysis technique are particularly of benefit to us.


25 Caroline Lee, General Factor Analysis (BMD03M), Program No. C6.02.013, September, 1967 (Columbus, Ohio: Data Center, The Ohio State University).

In order to analyze the change that occurred in the census tracts between 1947 and 1960, we have computed a matrix of proportional change among the thirteen variables, using the following equation as suggested by Brown and Horton:

\[ C V_{ij} = \frac{V_{ij}(1960) - V_{ij}(1947)}{V_{ij}(1947)} \]

Where \( V_{ij} \) indicates variable, \( i \), for census tract, \( j \).
Thus each variable in the change analysis (\( C V_{ij} \)) represents the percent change which occurred between 1947 and 1960, using 1947 as a base.

Brown and Horton contend:

...These variables reflect the ratio of change in the internal structure of each census tract. If the relative value of a particular variable decreases from 1950 (1947 in the case of Alexandria) to 1960, \( C V_{ij} \) would be negative; if the relative value of a particular variable increases from 1950 (1947 in our case), to 1960, \( C V_{ij} \) would be positive; if no change occurred, the resulting \( C V_{ij} \) for the change analysis would be zero."27

After calculating the ratio of change between both years, an application of a principal factor solution with an orthogonal rotation to the set of thirteen change variables for each of the 170 observations will be undertaken to extract the underlying dimensions of change. In our case, there are three dimensions of change.

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27Brown and Horton, ibid., p. 6.
A hierarchical grouping technique, developed by Veldman,\textsuperscript{28} will be conducted to determine the possible cluster of change. This technique analysis would determine to what extent a set of $N$ variables, observations, test items, etc., measured on $K$ different variables, there exist natural groups among the $N$-object groups which are similar to their scores on the $K$ variables used to describe them.\textsuperscript{29}

Operationally, this is done by subjecting the set of component scores of the 170 census tracts on the four change components to a step-like grouping routine\textsuperscript{30} which operates on the general principle of minimizing within group variance, while maximizing between group variances.

To obtain optimal grouping, the HGROUP Technique defines each original object as a "group." The $N$ groups are reduced in numbers by a series of step-decisions until all $N$'s have been classified into a number of similar groups.\textsuperscript{32}

\begin{flushright}

\textsuperscript{29}Ibid.

\textsuperscript{30}HGROUP Program's System Cards available in the Data Center, The Ohio State University, and the program itself is discussed in Veldman (1967).

\textsuperscript{31}Brown and Horton, \textit{op. cit.}, p. 10.

\textsuperscript{32}Veldman, \textit{op. cit.}, p. 309.
\end{flushright}
Residential Segregation and Techniques of Centralization

Our study also attempts to deal with the following question:

To what extent are the status and religious groups in Alexandria residually differentiated from each other? In so doing, we will attempt to examine a series of hypotheses about urban residential patterns, largely formulated on the basis of U.S. data, in another society.

Research on the differences in residential location, in terms of socio-economic variables, was originally initiated by the Duncans in their study of residential distribution and occupation stratification. This original study has inspired, as we shall see later, other studies of various cities in the United States, as well as other cities around the world. These studies have proved that ecological analysis is a promising approach to the study of urban social stratification by delineating the spatial aspects of the stratification phenomena.


A set of methodological techniques developed by the Duncans in their original study to deal with the relationship between spatial and social distance in urban communities are being replicated by most scholars.

For the purpose of our analysis of residential patterns in Alexandria, we attempt to apply the same techniques to deal with the second problem to which our study is partially addressed. Our effort here can be viewed as another attempt to add to the literature, one more study showing city residential patterns that are in some respects variant from the U.S., and to present an inclusive case study of a developing city.

**Data Preparation.**—Data for the present analysis are from the published census of population of Alexandria for 1960. The analysis will be limited to 1960 due to a lack of comparable data between 1947 and 1960. Three variables are chosen for the final analysis: occupation, education, and religion. In connection with the first

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35Occupations by census tracts are classified into 11 categories: Technical-Professional; Executive-Managerial; Clerical Office; Sales and Commerce, Agriculture; Hunting-Fishing; Mining and quarrying; Transport and Communication; Artisans and Craftsmen; Service and Entertainment; Unclassified Occupations, and Unemployed.

36Education by census tracts are classified into 8 categories: Illiterate; Barely Reads; Reads and Writes; Elementary School; Completed Intermediate; Went Beyond Intermediate; College or Higher, and Not Indicated.

37Religious affiliations by census tracts are classified into four categories: Muslims; Copts; Jews, and Other Christians.
variable, agriculture, hunting, fishing, and mining and quarrying are eliminated from the analysis.

The analysis is carried through two stages suggested by the Duncans. 38

(1) We have delineated the 116 census tracts into which the city was administered in 1960.

(2) We have drawn rather an arbitrary scheme of zones and sectors of the city. Then we have assigned census tracts to four sectors: Northeast, Southeast, Northwest, and Southwest (See Map No. 1).

Nine zones are suggested by the geographical peculiarity of the city. Tracts are assigned to the nine zones concentric to the City's center with one kilometer intervals up to the fifth kilometer, then with three kilometer intervals up to the ninth zone.

Combining the zones and sectors yielded a set of 26 zone-sector segments. Since Alexandria's growth has spread out toward the East, with little growth toward the West, nine zones are located eastward with only seven zones westward.

It is apparent from Map 1 that the sectors are triangular with a common apex at the city's center. 39 The final analysis is

38 Otis D. Duncan and Beverly Duncan, op. cit., p. 494.

39 This city center was delineated by Abd al-Hakim, op. cit., based on information regarding the functional specialization of this section of the city.
MAP 1

SECTORAL AND ZONAL PATTERN OF ALEXANDRIA, 1960
MEDITERRANEAN SEA

KILOMETERS

0 1 2 3

DRIA, 1960
confined to 98 census tracts and the remaining tracts are eliminated from the analysis because they are located mostly in the southeast section of the city which mainly consists of satellite agricultural communities. Three tracts in the western section of the city were eliminated for the same reason.

The Techniques of Analysis.—Three indexes were used to deal with the differences between the areal distribution of status groups in Alexandria.

1. The index of dissimilarity.—This index is computed using the percentage of all persons in a given category residing in each area unit. The index of dissimilarity between two groups is then one-half the sum of the absolute values of the differences between the respective distributions, taken area by area. The formula used for calculation purposes is:

\[
\text{Index of Dissimilarity} = \frac{1}{2} \sum_{i=1}^{k} |x_i - y_i|
\]

where \( P \) is the proportion of the total persons included in a given category.

2. The index of segregation.—This index is similar to the index of dissimilarity, except that now the residential distribution of a given group is compared to the residential distribution of all the other groups taken together. The Duncans have suggested an "adjustment" for this technique by dividing the result by one minus the proportion of the total persons within a given category. The index of segregation is given by:

\[
\text{Index of Segregation} = \frac{1}{1 - \sum_{i=1}^{k} P_i}
\]

where \( P_i \) is the proportion of the total persons in the given category.

\[\text{(40)}\]

O. D. Duncan and B. Duncan, op. cit., p. 498.
dissimilarity has to be calculated first, then apply the following formula:

\[
\text{Index of Segregation} = \frac{\text{Index of Dissimilarity}}{1 - P}
\]

where \( P \) is the proportion of the total persons included in a given category.

3. The index of centralization.—This index is computed in the same fashion, except that tracts are ordered by distance from the center of the city, that is, classified according to the zonal scheme. This index measures the extent to which a given group is centralized with respect to the rest of the population.

The index of centralization is given by the formula:

\[
I_C = \frac{\sum x_i - \sum y_i}{2(1 - P)}
\]

where \( x \) and \( y \) are the respective cumulative percentages, and \( P \) is the proportion of the total persons in a given category.

The high index values with the positive (+) indicate centralization and high values with the negative sign (-) show decentralization of the given group with respect to all other groups in the population.

In addition to these three techniques, we have selected a random sample of 36 census tracts by zones and sectors and employed a two-way analysis of variance for the 36 census tracts, data to determine the spatial distribution of variables. (BMDO2V Routine, Data Center.)
Areal Distribution of Status Groups and the Application of Centrographic Measures

To deal with the third major problem as specified in the objectives of this study, it is necessary, to adopt a kind of technique which might enable us to determine the location of status groups. We need to know what location is the most "central" to our population, and in what direction this population has moved during 1947 and 1960.

The current literature on spatial segregation of the population in cities suggests a number of methods.\(^{41}\) Douglass B. Lee in a recent monograph\(^ {42}\) pointed out the fact that these methods vary widely in the extent to which they have been applied. Some methods of areal distribution use mapping techniques. In this case, the locations of the individual points may be mapped. Fractiles or percentages can be computed before mapping, or ratios or pure numbers can be indicated.

In fact, geographers and human ecologists have discussed a wide range of techniques for analyzing areal distributions. Social area analysis, for example, can be viewed as an empirical method for spatial differentiation.\(^ {43}\)


\(^{42}\)Douglass B. Lee, Analysis and Description of Residential Segregation: An Application of Centrographic Technique to the Study of Spatial Distribution of Ethnic Groups in Cities (Ithaca, New York: Center for Housing and Environmental Studies, Division of Urban Studies, Cornell University, 1967).

The aim of this method, as Lee notes, "is to maximize within-unit homogeneity and between-unit heterogeneity by analyzing numerous variables by means of factor analysis. This method has been applied to analyze the variables between census tracts on the basis of three factors: social rank, urbanization and segregation." 44

Lee suggests a set of techniques called centrographic measures and notes that one major difference between social area analysis and centrographic methods is that the social types pertain only to a particular tract while centrographic measures always apply to the city area as a whole, and not to any specific portion of the city. 45

The centrographic technique is a combination of six different, but related, measures. Lee devoted one whole chapter in his monograph to describe and discuss the methodological functions of these measures. The summary of the measures will be useful here:

1. Mean Center, a measure of the location of a population.
2. Standard Distance, a linear or one-dimensional measure of the spread of the population.
3. Standard Radius, a two-dimensional measure of the spread of the population, or polar deviations.
4. Principal Axes, indication of the major direction of the dispersion.
5. Standard Ellipse, or ellipse of density, a graphic portrait of the other measures.

44 Douglass B. Lee, op. cit., p. 11.

Lee used a computer program which produced centrographic measures for ethnic groups using boundary definitions that usually covered different areas of the same city in different years. For example, if a city was classified as a SMSA in some particular year, then the study areas included the counties in the SMSA; if only the city was tracted, then that was the boundary.

Some empirical problems, however, required that Lee modify his programs to deal with those problems resulting from difficulties from definitions of boundaries, population distribution, and the shape of such distribution.

For practical reasons, we have decided not to use all six techniques suggested by Lee, but to choose from them a number of techniques relevant to our specific problem. Our examination of the spatial location of status and religious groups in Alexandria is confined to the following three analyses:

1. An analysis of the location of the various groups using the mean center technique.
2. An analysis of the spread of the various groups using the standard radius technique.
3. An analysis of the out-of-roundness of the distribution of the various groups using the Coefficient of Circularity technique.

The areal distribution of population in Alexandria is not known. Thus, our interpretation has to be done carefully. We believe that the three

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46 Ibid.

47 Ibid.
suggested measures are sufficient for this initial investigation.

**Data preparation.**—Data for the present analysis are from published census reports of population for the city of Alexandria for 1947 and 1960. We have employed socio-economic variables—occupation, education, and religion—instead of ethnic background variables. The "areal unit" for our analysis is the census tract. The number of observations are for a total of 170 census tracts; 85 for each year.

To compute the measures, it was necessary to locate our population on x and y coordinates. Since the areal unit is the unit of analysis, the center of each census tract is located to represent the area, i.e., the census tract.

**Selected centrographic measures.**—The mean center is defined by Lee as a measure of the location of population. Sometimes it is defined as "the mean point," "centroid," or "center of gravity." 48 The underlying assumptions of the measure imply that the population is distributed according to the bivariate normal probability law, then knowledge of the means of two marginal distributions determine a specific density function from the bivariate normal family. 49 Thus, the intersection of the means is called the mean center in centrography. According to Lee, this "mean center" is directly analogous to the arithmetic mean. 50

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The mean center is given by the formula:

\[ x_0 = \bar{x} = \frac{\sum x_i}{N} \quad y_0 = \bar{y} = \frac{\sum y_i}{N} \]

for grouped data, Lee suggests that the average will be a weighted average:

\[ x_0 = \frac{\sum w_i x_i}{N} \quad y_0 = \frac{\sum w_i y_i}{N} \]

where \( N = \sum w_i \).

General properties of the mean center are summarized by Lee to indicate that it is a central location, a center of gravity, and an expected location in the sense that the mean is an expected value.

**Standard radius.**—The single most important statistic, as Lee argues, is the standard radius which tells us how much the group is spread out. Accordingly, it is a measure of dispersion of the population. He contends:

The standard radius is a measure of dispersion of the population in all directions and is measured from a point, and is therefore a single unique number which applies to the entire distribution analogous to the standard deviation for one-dimensional variables.\(^{52}\)

It can be approached using the following formula suggested by Lee, which is the square root of the sum of the \( x \) and \( y \) variances, or standard distance:

\[ s_r = \sqrt{\sigma_x^2 + \sigma_y^2} \]

\(^{51}\)Ibid., p. 23.  \(^{52}\)Ibid., p. 27.
The square root of the $x$ variance is the standard distance about the line $y = \bar{y}$, and the square root of the $y$ variance is the standard distance about a line through the mean center and parallel to the $x$ axis... \(^{53}\)

Thus the standard radius of a population can be computed by dividing the population into areas of any size and shape, finding the standard radius for each area (within group variation) and then finding the standard radius of the (weighted) centers of the groups (between-group variation). \(^{54}\)

**Coefficient of Circularity.** This is a measure of out-of-roundness, or directionality of the distribution. This measure is given by the following formula

$$C = \frac{S_{yp}}{S_{xp}}$$

which is the ratio of the standard distance about the major axis to the standard distance about the minor axes.

Since the standard distance about the minor axis is always larger, the ratios vary from zero, which would be for a straight line to unity, which would be for a circle. \(^{55}\)

\(^{53}\)Ibid., pp. 28-29. \(^{54}\)Ibid., p. 31. \(^{55}\)Ibid., p. 34.
While a number of other centrographic measures are available, we have confined our analysis to these three specific measures in order to answer the following question: Where is the central location of our population, in what direction does it spread, and to what extent?

All calculations for the formulas are undertaken using a computer program developed and modified by John F. Hultquist from the University of Iowa.

Hypotheses

A set of hypotheses about urban ecological structure could be drawn upon for our investigation on Alexandria. These hypotheses are based largely upon findings from Western and Non-Western cities, in order to focus on both the factor structure of Alexandria, and the spatial ecological patterning of the social area analysis variables. It should be noted that the suggested hypotheses are formulated to deal with the expected factor structure of ecological variables and with the spatial differentiation of status groups in the city.

Hypothesis 1.—The first hypothesis deals with the spatial patterning of the social area analysis, and is based mainly on the work of Abu-Lughod (1969) and Berry and Rees (1969).

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Since the level of modernization in Egypt is not equal to that of the United States, we would not expect as great a factorial separation of the social area variables for Alexandria as found for U.S. and Canadian cities. If this hypothesis proved to be true, we will confirm Abu-Lughod's major findings in Cairo, that is, "no factorial separation between the indicators of social rank and the indicators of family cycle stage could be obtained." If this hypothesis is rejected, we will attempt to find out in what way Alexandria differs from Cairo. The social area change analysis will enable us to determine the direction and nature of any changes that might have occurred between 1947 and 1960.

**Hypothesis 2.**—This hypothesis is based upon findings reported for cities in the United States, England, and India. Ecological analyses of residential distribution of socio-economic groups in U.S. cities (as well as others outside of the United States) show a distinct pattern. Findings in U.S. cities suggest that residential segregation

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is greater for those occupation groups with clearly defined status than for those groups whose status is ambiguous. In the study of Oxford by Collison, we noticed that differences in social status between the occupations are paralleled by differences in residential dissimilarity. Residential segregation was particularly marked among the groups with the highest status, while differences at the termination of education also showed segregation.

In the case of Alexandria, we expect the residential pattern among socio-economic groups to be a graded hierarchy in the extent of residential dissimilarity as one moves up the socio-economic ladder, and segregation in residence is greatest for the highest and the lowest status groups. This might be consistent with what Mehta found in India.

Hypothesis 3.--We expect religion to be one of the factors which underly residential patterning among social groups in Alexandria.

Hypothesis 4.--This hypothesis deals with the spatial location of status groups in Alexandria. Research on U.S. cities has revealed that the center of the city has become less attractive for the high socioeconomic groups; poorly-educated and low-income groups have been found to be over-represented among the residents of the inner or central city. Our hypothesis states that in contrast to the usual ecological pattern of American cities, people of the highest social class live closest to the center of the city. This hypothesis is based on findings

63 Otis D. Duncan and Beverly Duncan, op. cit., p. 497.
64 Peter Collison, op. cit., p. 591.
on non-U.S. cities, in South America, Asia, and Europe. However, we may expect some variation in this pattern between 1947 and 1960.

Schnore's speculation in regard to the spatial structure of a modernizing city should be put under test. As Schnore contends, "with growth, modernization, and aging, the central portions of the city become less attractive residentially, and the upper class migrates toward the periphery."^66

Hypothesis 5.—Since we are going to use data for 1947 and 1960, some variation in the city's ecological structure could be expected with relation to the degree of differentiation, residential patterns, and the spatial location of status groups.

^65 See, for example, Peter Collison and John Moge, op. cit.; Leo F. Schnore, "On the Spatial Structure of Cities in the Two Americas," in Philip Hauser and Leo Schnore (eds.), The Study of Urbanization, op. cit., and Surinder K. Mehta, op. cit.

^66 Schnore, op. cit., p. 367.
CHAPTER III

THE CITY OF ALEXANDRIA: HISTORY AND DEVELOPMENT

Introduction

The study of spatial distribution of the population of a city requires some understanding of many factors which have shaped its contemporary pattern. The historical, physical, cultural, and economic factors, singly and in combination, affect any city's spatial patterning. In order to understand the present ecological pattern of a city such as Alexandria, a comprehensive, historical portrait has to be compiled.

The historical background of a given city has other important implications. The historical analysis enables the researcher to compile trends in population growth, decline, densities and pertinent data relevant to the city which give him a clear picture. A second major implication relates to the types of human population living in the city, the concentration, migration, and distributional processes.

In this chapter we attempt to look at the history of Alexandria, its growth and demographic characteristics, in order to analyze its contemporary ecological structure.

Historical Background

"Few cities have made so magnificent an entry to history as Alexandria, or, the "great city" as it was known in the latter days

of the ancient World." History tells us that the city was founded by "Alexander The Great" and it has been known by his name ever since.

Most scholars agree on the fact that the city came into being in the year of 332 B.C., and was built on a narrow strip of land between "Lake Mareotis" and the sea. Alexandria was first built, as history tells us, on an Egyptian town which existed as long as 1300 B.C., and which was known as "Rhakotis." In 331 B.C., Alexander, with the help of an architect, first thought about building a city to carry his name and to resemble the Greek city which was established in the fifth century. Accordingly, the city was laid out to rigidly straight lines from north to south and east to west. Westward it terminated at the sea; eastward it proceeded to Canopus (now known as Aboukir, see Map 2).

The city was divided into different sections to correspond to the various elements in its population and life. The intersecting main streets of the original plan divided it naturally into quarters, although there were five districts known by the Greek letters from A to E.

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3This lake is known now as Lake Mariote and still holds one of the basic typographic features of the modern city. See Map 2.


6Ibid.
After Alexander's death, Alexandria became the capital of Potlemaic Egypt, and a center of foreign domination of Egypt. It was said that Alexandria became the most populous city on the Mediterranean Sea. However, no accurate figure is given regarding the number of inhabitants in the ancient city after its establishment. During Greco-Roman rule, it was said that the city's population reached the figure of half a million.

It is known, nevertheless, that because of its strategic location in the ancient world, Alexandria attracted many foreigners to its great ports which were the basis of a flourishing commercial center.

Alexandria, however, has witnessed a long period of decay for almost thirteen centuries. By the year 641 B.C., when the Arabs entered Egypt, Alexandria was found to have decayed physically. During the thousand years and more that intervened between the Arab conquest of Egypt and its conquest by Napoleon, the events in the history of Alexandria are geographic rather than political.

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7 Historians say that the city was an approximate rectangle about one mile from north to south, and over three miles from east to west with the curves of the two harbors in front.

8 E.D. Hardy, op. cit., p. 7.

9 Hassan el Saaty, *Industrialization In Alexandria* (Cairo: Social Research Center, American University at Cairo, 1959), p. 29.


Forster furnishes a description of a geographical change which occurred in the 12th century:

The fundamental change was in the 12th century, when the Canopic mouth of the Nile silted up. Consequently the fresh water lake of Mariout (see Map 2) being no longer fed by the Nile floods, also silted and ceased to be navigable. Alexandria was cut off from the entire river system of Egypt, and could not flourish until it was restored...

During the Arab rule, the city continued to shrink westward and northward. Toward the end of the Arab rule, Alexandria regained some slight importance. The Mameluke Sultan of Cairo, Kait Bey, built on the ruins of the Pharos Island, the fine port that bears his name (1480).

By 1517, the Turks conquered Egypt and as Alexandria's physical decay continued, its population continued to shrink. A new settlement sprang up on the neck of the land that had formed between the two harbors. It still exists and is known as the "Turkish Town."

This town consisted of some houses which were built around Muslim Mosques.

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14 The Pharos Island is now the promontory of Ras-el-Tin Palace (see Map 2) it was believed to be the intervening channel which was silted up and attached to Rhakotis to be the first site of ancient Alexandria. There were no traces of any early settlement on its soil, but in the sea, north and west, the masonry of a prehistoric harbor has been found. See Forster, *op. cit.* pp. 7, 26, and 27.
While the period between 641 until the end of the 14th century was especially one of accelerated decay in the city's history, the city, however, did not lose its commercial function. When the political headquarters of the Islamic state was transferred from Bagdad to Cairo by the Fatimas when they invaded Egypt from North Africa in 969 A.D., Fustat and Alexandria became very important commercial centers.

Modern Developments

During the years 1798-1807, as many as four expeditions had landed at, or near Alexandria—one French, one Turkish, and two English. By the time of the French expedition, Alexandria had regained its importance as a seaport on the Mediterranean. It became a military base for the French, and later for the British. When Muhammad Ali became the ruler of Egypt in 1805, under the Sultan of Turkey, Alexandria became a maritime capital. To provide the city with fresh water after the British cut the dikes in 1801 to force the French to surrender.

Fustat is a town founded as an army encampment by the Arab conquerors in 641 A.D., which is considered as the earliest predecessor to contemporary Cairo. See Jane Abu-Lughod, The Ecology of Cairo, op. cit., pp. 132-133.


Muhammad Ali was an Albanian, but born in Cavala, Macedonia. He became the Ruler of Egypt in 1805 under the Sultan of Turkey.

In 1801, the British landed in Alexandria near Aboukir, under the command of Sir Ralph Abercrombie, not to occupy Egypt but to induce the French armies to evacuate it. After Sir Ralph's death, his successor, Hutchinson, ordered his army to cut the dike that separated Lake Mariout; he succeeded in making the French surrender and leave the country. See Forster, op. cit., pp. 91-93.
Muhammed Ali had to construct a canal 45 miles long, called the "Mahmoudieh Canal." (See Map 2.) Alexandria now had water communication with Cairo as well as communication by rail.

Scholars who studied the city's history and its modern development were convinced that the construction of "Mahmoudieh Canal" greatly implemented the development of the modern city; its population increase now far exceeds the size and volume of the cultivated land. The city has attracted both foreigners and natives.

As Alexandria grew in size and wealth, it was necessary to provide adequate transportation and to improve communications. Docks and arsenals were built and in 1856, Cairo and Alexandria were linked together by a railroad line; by 1858, it connected Alexandria with the City of Suez on the Red Sea. Thus, Alexandria became a flourishing commercial center again. From 1862-1863, 72 percent of all exports were cleared through the Port of Alexandria; this increased to almost 94 percent by 1872.

By 1860, it was clear that no aspect of Alexandria's development was keeping pace with the needs of its population. New suburbs emerged toward the east, southeast, south and southwest as the city grew. The earliest development was along the line of Mahmoudieh Canal. To improve internal communication, the first railway service was provided between the center of the city and "Boulki," a nearby suburb.

Well-to-do merchants were able to live further afield. Two alternatives

\[20\] H. El Saaty, op. cit., p. 34.
Figure 2. Percent Population Increase in Alexandria compared to Cairo and Total U.A.R. Population
were open to them; Mex in the West and Ramleh in the East. The fine natural features of the Mex encouraged many people to settle there, but, the city has spread to the east. Ramleh, first served by a railway and now by good electric trams has emerged into a great suburb.

At the beginning of the 19th century when the city expanded eastward, there were a few scattered small villages but within a short period of time, these villages became the nucleus for Ramleh which was incorporated within the city limits in 1927.'

Abd al-Hakim furnishes us with a historical description of the city's growth and expansion during the first half of the 20th century:

1. Transportation and the improvements of communication within the city and its adjacent hinterlands, and with other inner parts of Egypt, with Cairo, and Marsa Matrouh in the west on the Mediterranean. By 1936, the railway line with Marsa Matrouh was completed (almost 295 kilometers). In addition to railway lines, transportation by automobiles, trucks and the construction of two highways between Cairo and Alexandria: the desert highway, and another highway which follows along the railroad line.

2. The most notable feature of the expansion of the city eastward is the construction of a long freeway along the shores of the Mediterranean, between Montazah Palace in the East and Ras-el-Tin Palace in the West.

3. The emergence of new suburbs. Once the original city became densely populated, there was an outward movement of both people and institutions—first to the West, but recently to the East.22

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21 Ramleh, or el Rami, is a relatively new suburb of Alexandria and its recent growth was due to the construction of a railroad line. When people started looking for more space, they were encouraged to go to this area by the cheap land values. Thus, Ramleh, which was a small village has become a very densely populated suburban area. See Forster, op. cit., pp. 98-99.

22 Abd al-Hakim, op. cit., 166-172.
Abu-Lughod views the development in communications between Cairo and Alexandria as impressive. She contends that a future megalopolis is destined to develop along the highways axis between the two cities as Egypt becomes increasingly industrialized and urbanized.

El Saaty points to four suburban developments: Mex in the West, Ramleh in the East, Muhorram Bey, along the northern bank of the Mahmoudiah Canal, and Sidi Bishr, in the eastern section, located around a shrine of a Moslem Sheikh, Sidi Bishr.

Industrial Development

Industry began to develop in Alexandria at the end of the 19th century. Improvements in transportation and communications in the second-half of the 19th century gave the city additional impetus for industrial growth. The period from 1899 onwards, was especially one of accelerated industrial expansion in textiles, leather, paper, and the tobacco and food industries.

Looking at Map 2, one gets the impression that industry in Alexandria is segregated to a specific section. Expansion must be made to other areas. The Mahmoudiah Canal has provided a better location for such industries in Siouf; other sections are el Hadra in the south, Mubarram Bey, and Karmouz. Industry has expanded also to Bakos which is located in a residential area in Ramleh and to Minet-el-Bassal and el Mex.


24El Saaty, op. cit. p. 33.
Large industries tend to be rather highly decentralized, but in the Siouf area there is specialization in the spinning and weaving of cotton; in the el Mex area are leather shops and other forms of light industry.\textsuperscript{27} Other industrial locations lack this specialization and are located in residential area near the central part of the city.

The center of the city is a commercial nucleus, a center of buying and selling. This center has expanded in recent years to the east to Ramleh and southward to Kom el-Dika. In this vicinity are large streets lined with shops, offices, banks - national and international, and entertainment places. Because of its higher land values, this area is not residential.

Recent changes in the physical, social and economic aspects have created further problems so that a master plan for the city had to be prepared by a group of experts sponsored by the Governorate of Alexandria.

Population Growth

From its earliest history, Alexandria has experienced an influx of diverse ethnic groups in its population. In Medieval Alexandria it was said to have only 60,000 inhabitants and the decay of the old city was reflected in a population decline. However, in 1800, during the French Expedition, the population was estimated to have reached 15,000.

The first census was undertaken by the Egyptian Census Bureau

\textsuperscript{25} Abd al-Hakim, op. cit., pp. 291-308. \textsuperscript{26} Ibid. \textsuperscript{27} Ibid.
in 1882. The population was estimated to be 232,263 inhabitants. Within 80 years, between the Expedition and the First Census, the city had regained its glory.\(^{28}\) Between the first census in 1882 and the eighth, in 1960, the population rose from 232,263 to 1,516,234.\(^{29}\)

This may be explained by the fact that Alexandria and Cairo have always contained most of the urbanites of Egypt.\(^{30}\) When we look at Cairo-Alexandria's share of the urban population in Egypt, we find that between the years 1897 and 1960, their share has been 64.9% (1897), 64.7% (1907), 56.3% (1917), 56.1% (1927), 55.0% (1937), 55.0% (1947).

In 1927 and again in 1937, Cairo and Alexandria combined, had populations amounting to about 12.5 percent of all Egyptians; by 1947, this percentage had increased to sixteen. In 1960, over 19 percent of were residents of the two largest cities.\(^{31}\)

The growth of the population of Alexandria may be traced in fairly accurate measure since 1882. Since the second half of the 19th century the population of the city has shown rapid increase as it appears in Table 2.


\(^{29}\)Egypt, *The Census of Egypt, 1947* (Governorate of Alexandria) Table I, p. 3.

\(^{30}\)United Arab Republic: *Census of Population, 1960* (Governorate of Alexandria)

\(^{31}\)J. Abu-Lughod, *op. cit.*, (Table 3), pp. 323-324.
MAP 2
RESIDENTIAL AND LAND USE AREA MAP, ALEXANDRIA, 1960
The natural increase in Alexandria’s population has played an important role in its growth. The high increase of the birth rate over the death rate is evident in the city's natural growth, although since the turn of the century, there has been a decline in the death rate. The death rate has dropped from 32.2 per 1,000 population in 1900 to 18 per 1,000 population in the 1960's.

TABLE 2.—Population of Alexandria 1882-1966 and Percentage of Annual Increase

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Percentage of Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1882</td>
<td>232,636</td>
<td>---</td>
</tr>
<tr>
<td>1897</td>
<td>315,844</td>
<td>1.2</td>
</tr>
<tr>
<td>1907</td>
<td>353,807</td>
<td>1.2</td>
</tr>
<tr>
<td>1917</td>
<td>444,617</td>
<td>2.3</td>
</tr>
<tr>
<td>1927</td>
<td>573,063</td>
<td>2.6</td>
</tr>
<tr>
<td>1937</td>
<td>685,736</td>
<td>1.8</td>
</tr>
<tr>
<td>1947</td>
<td>919,024</td>
<td>3.4</td>
</tr>
<tr>
<td>1960</td>
<td>1,516,234</td>
<td>4.4</td>
</tr>
<tr>
<td>1966</td>
<td>1,801,056</td>
<td>3.3</td>
</tr>
</tbody>
</table>

1Based on official Government Census Reports.
2This year marks the first official census of the country.
In-migration has played a significant role in the growth of Alexandria's population. It is estimated that in 1947, 30.6% of the total population was born outside the city, and this percentage has decreased to 28.4% in 1960. This means that more than one-fourth of the city's total population were migrants in 1960.

Of even more significance are the city's foreign-born inhabitants. The flow of migrants from other countries is as old as the city itself. The city gained a substantial increase in its foreign stock during the second half of the 19th century. In 1897, the number of foreigners was estimated to be 14.5% of the total population in the city; in 1917 the number was estimated to have reached a peak of 19% of the city's population. However, their number has decreased dramatically since 1947, and in 1960, constituted only 2.91% of the city's population.

This decline in the city's share of foreign-born population needs elaboration. During the fifties, especially after the Egyptian Revolution in 1952, a sense of nationalism was strengthened among the Egyptians which has had political, economic, and social implications. When the government began to adopt a national plan for economic development, most foreign investments were challenged. New legislation was aimed at

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33 These figures have been compiled by the author from different Arabic sources.
nationalizing most of the economic sector between 1956-58. Egyptians in Egypt, as has been the case in most post-colonial nations, began to lose many of their long-held privileges, and were required by law to hire and train Egyptians. The Egyptian Government demanded the ownership of at least 51% of all shares, in order to control the enterprises. Thus, funds were diverted for national development.

A national plan was developed for educational and vocational training programs to produce both technical and skilled workers needed for industrial development. Many positions which were formerly held by foreigners were filled by newly-trained Egyptians. Foreign companies after losing most of their economic power began reducing their staffs.

The rapid growth of Alexandria in recent decades has had the effect of increasing the overall density of population, especially in the older sections of the city. In 1917 the density ratio was estimated to be 6238 persons per square kilometer and had increased to 12,910 persons per square kilometer by 1947. However, the overall density of Alexandria has dropped to 5237 persons per square kilometer.

This drastic decline in density proved to be artificial, due to changes in the city's boundaries between 1947 and 1960. In fact, the overall density of population in the old sections of the city has not decreased. From this, one can infer that Alexandria has not experienced a decrease in density gradient and thus resembles many.
non-Western cities; as Western cities grow, in time they experience steady decreases in the density gradient. 34

From the preceding historical and demographic analysis, we can infer the following general ecological characteristics of the City of Alexandria:

1. Alexandria, as is the case of many non-Western cities, has a preindustrial history which may have had a significant impact upon its socioeconomic pattern.

2. During the British Expedition, foreigners had enjoyed a higher socioeconomic status, which gave them an advantage over the Egyptians in residential selection.

3. Suburban development beyond the old settled portion of Alexandria did occur. Modern improvements in transportation have encouraged well-to-do families to shift to Ramleh in the Eastern section of the city.

4. Some industrial suburbs have emerged, as in the southeastern area with the industrial cluster in Siouf.

5. Rural migration is very evident in recent studies.

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CHAPTER IV

FACTOR STRUCTURE AND CHANGE ANALYSIS OF ALEXANDRIA

1947-1960

As discussed in Chapter II, the study contains a set of variables all related to the ecological and demographic structure of Alexandria. The variables which were selected for final analysis are similar to those employed by Abu-Lughod (1966) in her study of Cairo.

Two reasons determined our use of the same variables for Alexandria: first, these variables are available in the census tract bulletins for the city, and, second, we will attempt to compare our results to those of Cairo.

The variables are: Sex Ratio, Fertility Ratio, Males, never-married, Females, never-married, Females divorced, Persons per Room, Male Literacy, Female Literacy, Females in School/Employed, Handicapped Ratio, Male Unemployment, Muslims in tract, and Density.

No argument is presented here that these thirteen indicators of demographic and socioeconomic characteristics are the best measures, or the only ones that could be devised. However, the Personian Product Moment Correlation Coefficient (Zero-order) between every variable for each of the two separate census years was computed. Table 3 shows all of the interconnections between the 13 variables. From this correlation matrix, the smallest number of factors could be determined, whose association with the original variables will explain all of the correlation coefficients shown.

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### TABLE 3. Intercorrelations of Thirteen Characteristics of Matrices of Alexandria, Egypt; 1947 Above the Diagonal, 1960 Below the Diagonal

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sex Ratio</td>
<td>-.12</td>
<td>.26</td>
<td>.12</td>
<td>-.01</td>
<td>-.18</td>
<td>.08</td>
<td>.09</td>
<td>.17</td>
<td>-.21</td>
<td>-.05</td>
<td>-.11</td>
<td>-.09</td>
<td></td>
</tr>
<tr>
<td>2. Fertility Ratio</td>
<td>.28</td>
<td>-.17</td>
<td>-.56</td>
<td>-.01</td>
<td>.79</td>
<td>-.67</td>
<td>-.71</td>
<td>-.54</td>
<td>.48</td>
<td>.33</td>
<td>.83</td>
<td>.17</td>
<td></td>
</tr>
<tr>
<td>3. Males, Never-Married</td>
<td>.30</td>
<td>-.43</td>
<td>.73</td>
<td>.12</td>
<td>-.32</td>
<td>.30</td>
<td>.21</td>
<td>.36</td>
<td>-.39</td>
<td>.04</td>
<td>-.08</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>4. Females, Never-Married</td>
<td>-.42</td>
<td>-.77</td>
<td>.58</td>
<td>.10</td>
<td>-.63</td>
<td>.58</td>
<td>.60</td>
<td>.56</td>
<td>-.51</td>
<td>-.12</td>
<td>-.45</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>5. Females, Divorced</td>
<td>-.24</td>
<td>-.38</td>
<td>.29</td>
<td>.56</td>
<td>-.01</td>
<td>-.01</td>
<td>-.02</td>
<td>.02</td>
<td>-.12</td>
<td>.18</td>
<td>.11</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>6. P.P.R.</td>
<td>.26</td>
<td>.72</td>
<td>-.30</td>
<td>-.68</td>
<td>-.29</td>
<td>-.81</td>
<td>-.82</td>
<td>-.63</td>
<td>.64</td>
<td>.35</td>
<td>.82</td>
<td>.06</td>
<td></td>
</tr>
<tr>
<td>7. Males, Literary</td>
<td>-.28</td>
<td>-.70</td>
<td>.31</td>
<td>.69</td>
<td>.25</td>
<td>-.84</td>
<td>.80</td>
<td>.68</td>
<td>-.70</td>
<td>-.24</td>
<td>-.69</td>
<td>-.05</td>
<td></td>
</tr>
<tr>
<td>8. Females, Lit.</td>
<td>-.29</td>
<td>-.81</td>
<td>.45</td>
<td>.84</td>
<td>.35</td>
<td>-.82</td>
<td>.87</td>
<td>.70</td>
<td>-.67</td>
<td>-.25</td>
<td>-.73</td>
<td>-.05</td>
<td></td>
</tr>
<tr>
<td>9. Females, School/Employed</td>
<td>-.36</td>
<td>-.76</td>
<td>.22</td>
<td>.76</td>
<td>.59</td>
<td>-.76</td>
<td>.71</td>
<td>.80</td>
<td>-.69</td>
<td>-.10</td>
<td>-.53</td>
<td>-.01</td>
<td></td>
</tr>
<tr>
<td>10. Handicapped</td>
<td>.15</td>
<td>.45</td>
<td>-.12</td>
<td>-.40</td>
<td>-.19</td>
<td>.38</td>
<td>-.47</td>
<td>-.54</td>
<td>-.50</td>
<td>-.10</td>
<td>.44</td>
<td>-.08</td>
<td></td>
</tr>
<tr>
<td>11. Male, Unempl.</td>
<td>.16</td>
<td>.36</td>
<td>-.26</td>
<td>-.48</td>
<td>-.18</td>
<td>.35</td>
<td>-.35</td>
<td>-.55</td>
<td>-.35</td>
<td>.25</td>
<td>.40</td>
<td>.11</td>
<td></td>
</tr>
<tr>
<td>12. Muslims</td>
<td>.02</td>
<td>.56</td>
<td>-.14</td>
<td>-.40</td>
<td>-.10</td>
<td>.66</td>
<td>-.62</td>
<td>-.66</td>
<td>-.62</td>
<td>.38</td>
<td>.21</td>
<td>.19</td>
<td></td>
</tr>
<tr>
<td>13. Density</td>
<td>.00</td>
<td>.00</td>
<td>.14</td>
<td>.07</td>
<td>-.01</td>
<td>.03</td>
<td>-.03</td>
<td>-.01</td>
<td>-.15</td>
<td>-.02</td>
<td>-.00</td>
<td>-.00</td>
<td></td>
</tr>
</tbody>
</table>
While this matrix of correlation coefficients shows the inter-correlation among the variables, it is argued by Daniel O. Price\(^1\) that they do not, in general, provide us with any scientific, meaningful structure.

To test the first hypothesis we calculated a factor analysis on the tract data for each of the 85 census tracts. We employed a principal component analysis with orthogonal rotation.

Three factors were extracted from the correlation matrices for both years. An analysis with six factors was also performed, which produced similar factor loadings. Our final analysis pertains only to three factors. The three orthogonal dimensions which are extracted in each case show similar patterns and structures. Table 4 describes a summary of cumulative percent variance, explained by the extracted three factors for each year.

**TABLE 4. Cumulative Percentage Variance Explained by the Extracted Factors for 1947 and 1960**

<table>
<thead>
<tr>
<th>Factor Number</th>
<th>Sum of Squares</th>
<th>Cum. Percentage Explained Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>I 1947</td>
<td>5.62559230</td>
<td>45.51</td>
</tr>
<tr>
<td>1960</td>
<td>5.74978461</td>
<td>49.18</td>
</tr>
<tr>
<td>II 1947</td>
<td>1.85989330</td>
<td>59.03</td>
</tr>
<tr>
<td>1960</td>
<td>1.66551230</td>
<td>59.96</td>
</tr>
<tr>
<td>III 1947</td>
<td>1.48810769</td>
<td>67.75</td>
</tr>
<tr>
<td>1960</td>
<td>1.61707927</td>
<td>69.66</td>
</tr>
</tbody>
</table>

TABLE 5. Ecological Factors in Alexandria, 1947 and 1960; Loadings of Thirteen Variables on Three Factors (Orthogonal Rotation)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sex Ratio</td>
<td>.02663</td>
<td>.16379</td>
<td>-.19585</td>
<td>.16254</td>
<td>(.75292)</td>
<td>(.89309)</td>
</tr>
<tr>
<td>2. Fertility Ratio</td>
<td>(-.81568)</td>
<td>(.81686)</td>
<td>.30743</td>
<td>-.24285</td>
<td>-.06762</td>
<td>-.19464</td>
</tr>
<tr>
<td>3. Males, Never-Married</td>
<td>.31286</td>
<td>-.37404</td>
<td>.35814</td>
<td>(.78576)</td>
<td>(.71786)</td>
<td>-.32424</td>
</tr>
<tr>
<td>4. Females, Never-Married</td>
<td>(.68248)</td>
<td>(-.71807)</td>
<td>.17369</td>
<td>(.49307)</td>
<td>(.47339)</td>
<td>.38985</td>
</tr>
<tr>
<td>5. Female, Divorced</td>
<td>.01180</td>
<td>-.26509</td>
<td>(.47818)</td>
<td>(.45641)</td>
<td>.11554</td>
<td>(.53003)</td>
</tr>
<tr>
<td>6. Persons per Room</td>
<td>(-.90725)</td>
<td>(.87945)</td>
<td>.17124</td>
<td>-.05192</td>
<td>-.14016</td>
<td>-.12738</td>
</tr>
<tr>
<td>7. Male Literacy</td>
<td>(.90627)</td>
<td>(-.88153)</td>
<td>-.01599</td>
<td>.05026</td>
<td>.01901</td>
<td>.12111</td>
</tr>
<tr>
<td>8. Female Literacy</td>
<td>(.91230)</td>
<td>(-.92586)</td>
<td>-.08059</td>
<td>-.21999</td>
<td>.01400</td>
<td>.16361</td>
</tr>
<tr>
<td>9. Females, School/Employed</td>
<td>(.77996)</td>
<td>(-.82781)</td>
<td>.11362</td>
<td>.06819</td>
<td>.20916</td>
<td>.38878</td>
</tr>
<tr>
<td>10. Handicapped</td>
<td>(-.75815)</td>
<td>(.58288)</td>
<td>-.32054</td>
<td>.01605</td>
<td>-.21560</td>
<td>-.10983</td>
</tr>
<tr>
<td>11. Male Unemployed</td>
<td>-.26352</td>
<td>.42865</td>
<td>(.64887)</td>
<td>-.30302</td>
<td>.05016</td>
<td>-.15292</td>
</tr>
<tr>
<td>12. Muslims</td>
<td>(-.81460)</td>
<td>(.82546)</td>
<td>.42461</td>
<td>.22781</td>
<td>.01840</td>
<td>-.17877</td>
</tr>
<tr>
<td>13. Density</td>
<td>.05312</td>
<td>.17875</td>
<td>(.62607)</td>
<td>(.54640)</td>
<td>-.28331</td>
<td>.03372</td>
</tr>
</tbody>
</table>
Before making any effort to identify the factors, an attempt is made to determine the degree of congruence or similarity between the census years. Table 6 shows the degree of congruence or similarities between the factors in the two census years. A method of computation of the coefficient of congruence is suggested by Harmon:

\[
\phi_{pq} = \frac{\sum_{j=1}^{n} 1^{a_{jp}} 2^{a_{jq}}}{\left(\sum_{j=1}^{n} 1^{a_{jp}}\right)\left(\sum_{j=1}^{n} 2^{a_{jq}}\right)}
\]

**TABLE 6. Factor Congruence, 1947 and 1960**

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>1947</th>
<th>1960</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>.98</td>
<td>.35</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td>.62</td>
</tr>
<tr>
<td>III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For Factor I in both years, the coefficient of congruence is .98, which is considered to be very high. Factor III yields a coefficient of .82 for both years. Generally, we can infer from the coefficient of congruences that our factors are similar. Harman provides us with an explanation for high coefficients:

Since a small number of variables usually will be common to two studies, it is evident that the coefficient of congruence will be high so long as there are factor weights with like algebraic signs in the two instances... In situations where factors from two studies can be matched visually, and the number of variables common to the studies is small, it can be expected that the coefficients will be very high. 3

Identification of the Three Extracted Factors

The first factor extracted for both years is related to almost identical variables measuring fertility, delayed age at marriage for females, persons per room, education, employment status, and ethnic background (percentage Muslims in tract).

For 1947, Factor I is identified with fertility ratio (negatively related), never-married females (positively associated), the number of persons per room (negatively related), male literacy (positively associated), female literacy (positively related), females enrolled in school or in the labor force (positively related), male unemployment (negatively related), and percentage of Muslims living in each tract (negatively related).

While the factor loading for Factor I for 1960 is identical to the factor loading for the same factor in 1947, changes in the signs do occur. These changes can be observed for all the variables which seem to define the social organization of the city in both years. Such changes must be taken into consideration when looking at the spatial

3Harman, ibid, p. 271.
distribution of factor scores. We find that the factor loadings for both years, reflect a general social organizational vector for the city. However, it could be identified, tentatively, as a socio-economic status, or "style of life" factor. The identification of Factor I as a socio-economic factor is explained by knowing the determinants of social class position in the Egyptian Society. For Alexandria, as for Cairo, class position is a major determinant of family variations. Comparisons between Cairo and Alexandria, in terms of factor loadings for Factor I, yield identical patterns.5

Thus, higher socioeconomic status is associated with low fertility, high level of education (especially for females), and with delayed age at marriage. This has been partially confirmed in a recent investigation with relation to female education and differential fertility. In this study with relation to education and occupational class of husband, Abu-Lughod concluded that

...education appears to be a most significant variable in the fertility of urban Egyptian women. There is a clear inverse relationship between the educational attainment of wives and the number of children born by them...6

---

5 Ibid., Table VIII, p. 193.
The spatial distribution of factor scores for both years confirmed the fact that the tracts which have higher scores on Factor I are located in the "better" areas in Alexandria.

Tracts are classified into four categories according to their relative ranking on factor scores. Maps 3 and 4 show the spatial patterning of Alexandria according to Factor I.

Close observation of orthogonal factor loadings for Factor I for both years permits some identification of similarities and differences in the dimensions along which residential areas are differentiated. Areas which have the highest factor scores are characterized by low fertility ratio, balanced sex ratio, delayed age at marriage for both sexes, high literacy rate for both males and females. It seems clear that the same underlying dimensions describe the spatial social and economic characteristics for both census years. Factor I, in fact, proves to be a sensitive indicator since it explains more than 50% of the total variance for both years.

Examining the comparability of factor loadings on Factor I for both census years with factor loadings on the other two factors, the first impression is the fact that inconsistencies exist. Such inconsistencies have created problems which prevent immediate identification.

The defining variables for Factor II for 1947 reflect relatively high factor loadings on male unemployment (+.64887), and demographic density (+.62607), and insignificant loadings on percentage of divorced
SOCIAL AREA MAP
ALEXANDRIA EGYPT 1960

MAP 4
females (+.47818). If we had to identify Factor II for 1947 only, it would have been possible to consider it as a social disorganization factor. This identification reflects the facts of social life in Alexandria as it did for Cairo. Abu-Lughod, for example, has identified the high loading on density (+.6180), and Handicapped Rate (+.6846) as reflecting social disorganization of the urban variety. But for Alexandria in 1947, Male Unemployment proved to be a sensitive indicator for social disorganization since it carries the highest factor loadings among the defining variables.

The identification of Factor II for 1960 raises a major problem. The fundamental, or the defining variables which explain all the correlations observed for this year are not quite comparable to those identified by Factor II for 1947. For 1947, Never-Married Males (positively related +.78576), only appears to be highly loaded on Factor II. Demographic Density (positively related) proved to be a fundamental variable which accounts for the ecological differentiation for 1960, as it is for 1947. Also, Never-Married Females (+.49307), and Females Divorced (+.45641) have factor loadings which might aid in identifying Factor II, yet their loadings seem to be insignificant. The reader might observe from Table 5 that Variables 3 and 4 in 1947 lack significant factor loadings as is the case in 1960. If we try to interpret the factor loadings for Factor II for 1960 as we have for 1947, we run into an ambiguous interpretation. However, the two factors are loaded

highly on Demographic Density and relatively high on Females Divorced.

One thing which contributed to such an ambiguous interpretation is the fact that the Male Unemployment variable does show considerable incomparability. While Male Unemployment loads high on Factor II for 1947, the same factor loads considerably lower on the same Factor for 1960. However, such low loadings for Male Unemployment for 1960 could give a dubious result, due to suspicious reporting of Male Unemployment in the 1960 Census.

If we look at each factor loading for Factor II for 1960, separately, our identification would be similar to that for 1947. That is, the high loadings on Never-Married Males and Females, the high proportion of Divorced Females, and high Demographic Density could be defining variables for social disorganization of the urban variety in Alexandria. This identification, however, should remain tentative until we look at the spatial distribution of factor scores according to Factor II.

Almost all of the census tracts which rank low on Factor II show some consistency in their relatively low ranking on Factor I, with the exceptions of some inner-city tracts in the old districts of el Gumrak, el Labban and Karmouz. The tracts which rank low on Factor II are characterized with low divorce rate among females, low ratios of handicapped and high density, which are common characteristics of almost all of the social areas in the city. While high literacy has proved to be also associated with "urbanism" in Egypt, Factor II, however, fails to

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predict it. The tracts which rank high on Factor II are located mostly in the areas which are characterized with a high degree of attraction to rural migrants in the Southeast section of the city. Some of these tracts have a high proportion of seasonal workers and construction workers who have migrated to the city from Upper Egypt, soon after the second World War. Demographic data for Alexandria indicate that more than 40 percent of the population were from outside of the Governorate. Rural migration, in general, has been viewed as the most contributive factor in the rapid increase of the population of Egyptian cities. This process has a considerable effect upon what is being identified as the ruralization process of cities. 9

The variables defining Factor III are to some extent similar to those variables defining Factor II. Table 6 shows that in 1947 there are significant factor loadings on Sex Ratio (positively related), Single Males (positively related), and with low loading on Single Females (+.47339). For 1960, Factor III loads high on Sex Ratio (negatively associated), and relatively high on Married Females now Divorced (positively related).

The identification of Factor III is difficult since the produced factor loadings for both years proved to be inconsistent. In fact, this is one of the difficulties in factor analysis when the investigator attempts to identify or give some meaning to the produced factors in light of the original data. For example, the factor loadings for 1947

9 Ibid., pp. 22-32.
SOCIAL AREA MAP
ALEXANDRIA, EGYPT 1960

MAP 6
Factor II, **SOCIAL DISORGANIZATION**

- ♦️ LOW
- □️ AVERAGE
- ☒️ HIGH

**MEDITERRANEAN SEA**
show that the variable, Single Women, has only a loading of (+.47339). When we look at the produced matrix of correlation coefficients, we see that the variable, Single Males has a coefficient of +.73 with unmarried women, while the same variable has a correlation coefficient of +.25 with Sex Ratio. By looking at Table 6, however, we notice such inconsistencies in the factor loadings.

However, the same set of factor loadings accounts for the degree of "independence" upon males which characterize most of the working class families. It has been found that some males in the working classes of Egypt are more likely to delay their marriage, or even not marry at all, to support their divorced female relatives and their children. Almost identical factor loadings were found for Cairo in 1947 and 1960; however, Abu-Lughod identified this factor as "male dominance." The spatial distribution of factor scores for Alexandria has not confirmed Abu-Lughod's identification since degree of "independence" is not a highly differential factor in social areas in Alexandria.

Looking at the factor structure of Alexandria, some other general observations must be added. The cross-sectional analysis of the data has confirmed that there is no factorial disassociation between familism and social rank. Both family and social rank variables are reflected in the ecological pattern of Alexandria. This general finding has proved to be consistent with Abu-Lughod's major findings in Cairo, and in contrast with the normal separation of these two sets of indicators in factor analyses of American city data matrices.10

10Brian J.L. Berry and Philip H. Rees, op. cit., p. 467.
What we have identified as a socioeconomic factor is not reflected in clearly separable indicators. It is, for example, highly associated with family characteristics, female status, literacy and occupational positions for both males and females.

One basic question which has not yet been raised in the present study is the accuracy of the identification of the factors as a summary of the ecological patterning, especially in cities in developing nations. It is obvious from the underlying factor structures of both Cairo and Alexandria that there are considerable simplifications with regard to the "naming" of the factors. This, in our view, is a very dangerous procedure.

In the case of Cairo and Alexandria, as the two largest metropolitan areas in Egypt, the first factor accounts for almost 50% of the explained variance. Any attempt, therefore, to identify more factors, in the case of Cairo and Alexandria, would lead to difficulties in interpretation. We argue this because many of the highly loaded variables seem to be inconsistent with the simple zero-order correlation coefficients.

Our findings, however, do support the first hypothesis in this study; that is, we have not found as great a factorial separation of the social area variables for Alexandria, using data for 1947 and 1960, as has been found for cities in the U.S., and Canadian cities. In addition, the extracted factors have confirmed that the social area structure of Alexandria did not change drastically over the period under investigation.
Differences and Similarities in the Ecological Structure of Cairo and Alexandria

The cross-sectional analysis of the social area variables which are unique to Alexandria for 1947 and 1960 has enabled us to identify some universal features common to both Cairo and Alexandria. The identification has been facilitated by employing the same variables used by Abu-Lughod in her study on Cairo.

Comparison between the factor loadings on the same lists of variables for both cities supports the fact that the factor analysis has produced consistent loading patterns over the period under investigation. The only question we have raised in this regard deals primarily with the proper identification of the factors. Table 8 shows the ecological factors in Cairo and Alexandria for 1947 and 1960. In order to determine to what degree the extracted factors are similar to each other, we have calculated the coefficient of congruence as suggested by Harman. Table 7 shows the degree of congruence among the factors in Cairo and Alexandria for 1947 and 1960.

Table 7. Coefficients of Congruence Between the Extracted Factors for Cairo and Alexandria, 1947 and 1960

<table>
<thead>
<tr>
<th></th>
<th>1947 Factors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>I</td>
<td>.91</td>
<td>.48</td>
</tr>
<tr>
<td>II</td>
<td>.84</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>I</td>
<td>.96</td>
<td>.64</td>
</tr>
<tr>
<td>II</td>
<td>.63</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
These measures indicate close congruence for Factor I in 1947 for both Cairo and Alexandria, and extremely close congruence for the same factor in 1960 for both cities. The same is true for Factor III in 1947 (.90). However, Factor II has failed to show such close congruence for 1960 (.63). This might be explained by looking at the factor loadings on Factor II for the 1960 data in Table 8. The first impression we have is incomparability between the factor loadings on the defining variables for this factor. This enables us to argue that change might have occurred in the ecological structure of Alexandria over the decade under investigation. This will be determined by using the change analysis model.

Before our discussion of the possible change and nature of variation in the ecological structure of Alexandria, some other observations regarding the differences in ecological structure between the two cities must be made.

Differences between the ecological structure of the two cities can be outlined by looking at Table 8. The loadings on Factor I in 1947, indicate that the loadings on Variable 12 (percentage of Muslims living in each tract) are high (-.81). To compare this with Cairo, we find the same variable has relatively low factor loadings (-.65). This might explain the unique case of Alexandria in regard to its ethnic composition. Alexandria has had a high percentage of foreigners, who have enjoyed a higher standard of living than the Egyptians for many years. The census tracts which rank high on Factor I in Alexandria for 1947 have a considerably higher proportion of foreigners than any other
TABLE 8. Ecological Factors in Cairo* and Alexandria, 1947 and 1960, Loadings on Three Factors (Orthogonal Rotation)††

<table>
<thead>
<tr>
<th>Variables</th>
<th>Factor I Cairo</th>
<th>Factor II Cairo</th>
<th>Factor III Cairo</th>
<th>Factor I Alex.</th>
<th>Factor II Alex.</th>
<th>Factor III Alex.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sex Ratio</td>
<td>-.00</td>
<td>.02</td>
<td>-.05</td>
<td>-.19</td>
<td>(+.96)</td>
<td>(+.75)</td>
</tr>
<tr>
<td>2 Fertility Ratio</td>
<td>(-.81)</td>
<td>(-.82)</td>
<td>+.20</td>
<td>+.30</td>
<td>-.20</td>
<td>-.06</td>
</tr>
<tr>
<td>3 Males, Never</td>
<td>(+.67)</td>
<td>+.31</td>
<td>.01</td>
<td>+.35</td>
<td>.12</td>
<td>(+.71)</td>
</tr>
<tr>
<td>4 Females, Never</td>
<td>(+.91)</td>
<td>(+.68)</td>
<td>-.07</td>
<td>.17</td>
<td>(+.62)</td>
<td>(+.47)</td>
</tr>
<tr>
<td>5 Females Divorced</td>
<td>(+.42)</td>
<td>.01</td>
<td>+.31</td>
<td>(.47)</td>
<td>.19</td>
<td>.11</td>
</tr>
<tr>
<td>6 Persons Per Room</td>
<td>(-.80)</td>
<td>(-.91)</td>
<td>.10</td>
<td>-.01</td>
<td>-.24</td>
<td>-.01</td>
</tr>
<tr>
<td>7 Male Literacy</td>
<td>(+.90)</td>
<td>(+.91)</td>
<td>.12</td>
<td>-.01</td>
<td>.06</td>
<td>.01</td>
</tr>
<tr>
<td>8 Female Literacy</td>
<td>(+.95)</td>
<td>(+.91)</td>
<td>-.03</td>
<td>-.08</td>
<td>.17</td>
<td>.01</td>
</tr>
<tr>
<td>9 Females - School/</td>
<td>(+.72)</td>
<td>(+.78)</td>
<td>-.07</td>
<td>.11</td>
<td>.13</td>
<td>+.20</td>
</tr>
<tr>
<td>Employed</td>
<td>10 Handicapped</td>
<td>-.08</td>
<td>(-.76)</td>
<td>(+.68)</td>
<td>-.32</td>
<td>-.04</td>
</tr>
<tr>
<td>11 Males Unemployed</td>
<td>(-.68)</td>
<td>-.26</td>
<td>-.38</td>
<td>(+.64)</td>
<td>-.28</td>
<td>.05</td>
</tr>
<tr>
<td>12 Muslims</td>
<td>(-.65)</td>
<td>(-.81)</td>
<td>.16</td>
<td>(+.42)</td>
<td>.02</td>
<td>.01</td>
</tr>
<tr>
<td>13 Density</td>
<td>-.18</td>
<td>.05</td>
<td>(+.62)</td>
<td>(+.63)</td>
<td>-.16</td>
<td>-.28</td>
</tr>
</tbody>
</table>

1960

<table>
<thead>
<tr>
<th>Variables</th>
<th>Factor I Cairo</th>
<th>Factor II Cairo</th>
<th>Factor III Cairo</th>
<th>Factor I Alex.</th>
<th>Factor II Alex.</th>
<th>Factor III Alex.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sex Ratio</td>
<td>-.01</td>
<td>.16</td>
<td>-.03</td>
<td>.16</td>
<td>(+.97)</td>
<td>(-.89)</td>
</tr>
<tr>
<td>2 Fertility Ratio</td>
<td>(-.89)</td>
<td>(+.81)</td>
<td>-.00</td>
<td>-.24</td>
<td>-.01</td>
<td>-.19</td>
</tr>
<tr>
<td>3 Males, Never Mar.</td>
<td>(+.76)</td>
<td>-.37</td>
<td>-.03</td>
<td>(.78)</td>
<td>.04</td>
<td>-.32</td>
</tr>
<tr>
<td>4 Females, Never Mar.</td>
<td>(+.95)</td>
<td>(-.71)</td>
<td>.11</td>
<td>(.49)</td>
<td>(.49)</td>
<td>+.38</td>
</tr>
<tr>
<td>5 Females, Divorced</td>
<td>(+.52)</td>
<td>-.26</td>
<td>(.41)</td>
<td>(.43)</td>
<td>.03</td>
<td>(.53)</td>
</tr>
<tr>
<td>6 Persons per Room</td>
<td>(-.81)</td>
<td>(+.88)</td>
<td>+.32</td>
<td>.05</td>
<td>-.07</td>
<td>.12</td>
</tr>
<tr>
<td>7 Male Literacy</td>
<td>(+.81)</td>
<td>(-.88)</td>
<td>.05</td>
<td>-.20</td>
<td>+.07</td>
<td>.12</td>
</tr>
<tr>
<td>8 Female Literacy</td>
<td>(+.92)</td>
<td>(-.93)</td>
<td>-.19</td>
<td>+.21</td>
<td>.10</td>
<td>.16</td>
</tr>
<tr>
<td>9 Females - School/</td>
<td>(+.85)</td>
<td>(-.82)</td>
<td>-.14</td>
<td>.07</td>
<td>.06</td>
<td>+.38</td>
</tr>
<tr>
<td>Employed</td>
<td>10 Handicapped</td>
<td>(-.40)</td>
<td>(+.58)</td>
<td>+.32</td>
<td>.01</td>
<td>.13</td>
</tr>
<tr>
<td>11 Males, Unemployed</td>
<td>-.31</td>
<td>(+.42)</td>
<td>.18</td>
<td>-.30</td>
<td>-.03</td>
<td>-.15</td>
</tr>
<tr>
<td>12 Muslims</td>
<td>(-.56)</td>
<td>(+.82)</td>
<td>(+.55)</td>
<td>+.22</td>
<td>-.06</td>
<td>.17</td>
</tr>
<tr>
<td>13 Density</td>
<td>-.03</td>
<td>.19</td>
<td>(+.72)</td>
<td>(+.54)</td>
<td>-.10</td>
<td>.03</td>
</tr>
</tbody>
</table>


††This comparison is based upon our findings in Alexandria and Abu-Lughod's in Cairo. We have placed Factor III for Cairo with Factor II for Alexandria since Factor II for Alexandria reflects the "social disorganization vector."

†††The ordering of variables presented in Abu-Lughod's study are replaced here for presentation to fit the ordering of our variables for Alexandria.
census tracts in the city. These findings could be supported by looking at the percentage distribution of population in Alexandria in 1947 by ethnic groups.

As shown in Table 9, foreigners in Alexandria are more concentrated in the area which can be called the "Garden City" of Alexandria. In the District of Ramleh (el Ram) there are three major census tracts which have gained the highest factor scores according to their socioeconomic status: San Stephano (+1.93868), Fleming (+2.77622), and Mustapha Basha (+2.15890). In the District of Muharem Bay, there are four major census tracts which have very high factor scores on Factor I; el Ibrahimia and Sidi Gaber (+2.04892), el Hedra (+1.81467), el Shatbi (+1.45179) and the census tract of Bab Sharki (+2.13094). These examples support our argument that the highest status groups in Alexandria are concentrated in these areas (See Maps 3 and 4).

The second marked contrast in the ecology of social class between Cairo and Alexandria appears in the loadings shown by Variable 5 (Females Divorced) on Factor I. While this variable has shown a positive loading with a socioeconomic rank in Cairo (+.42) and a very insignificant loading with socioeconomic rank in Alexandria (.01), such negligible loadings of this variable on the socioeconomic status shows a total lack of association, and indicates that divorced females are dispersed among residential areas of both high and low status. The factor loadings on the socioeconomic factor for both cities indicate that residential stability is associated with the higher socioeconomic status.
<table>
<thead>
<tr>
<th>Districts</th>
<th>Egyptians %</th>
<th>Other Arab Nationals %</th>
<th>Italians %</th>
<th>British %</th>
<th>Turkish %</th>
<th>French %</th>
<th>Greeks %</th>
<th>Others %</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Gumruk</td>
<td>13.90</td>
<td>1.40</td>
<td>0.60</td>
<td>0.92</td>
<td>5.54</td>
<td>7.80</td>
<td>1.22</td>
<td>1.08</td>
</tr>
<tr>
<td>El Attarin</td>
<td>6.79</td>
<td>(28.81)</td>
<td>(26.05)</td>
<td>(17.95)</td>
<td>18.42</td>
<td>(21.72)</td>
<td>(33.29)</td>
<td>(20.02)</td>
</tr>
<tr>
<td>El Labban</td>
<td>6.80</td>
<td>8.81</td>
<td>6.90</td>
<td>4.55</td>
<td>5.64</td>
<td>1.81</td>
<td>2.70</td>
<td>2.42</td>
</tr>
<tr>
<td>El Mansheyya</td>
<td>3.56</td>
<td>10.09</td>
<td>7.01</td>
<td>8.20</td>
<td>5.94</td>
<td>11.87</td>
<td>7.52</td>
<td>7.75</td>
</tr>
<tr>
<td>El Mina</td>
<td>0.06</td>
<td>0.95</td>
<td>0.09</td>
<td>0.90</td>
<td>0.70</td>
<td>0.27</td>
<td>0.10</td>
<td>8.10</td>
</tr>
<tr>
<td>Karmjuz</td>
<td>24.82</td>
<td>3.96</td>
<td>0.96</td>
<td>0.33</td>
<td>2.24</td>
<td>1.41</td>
<td>1.50</td>
<td>0.63</td>
</tr>
<tr>
<td>Muharem Bay</td>
<td>19.71</td>
<td>(31.18)</td>
<td>(44.38)</td>
<td>(45.83)</td>
<td>(49.42)</td>
<td>(42.77)</td>
<td>(46.15)</td>
<td>(43.35)</td>
</tr>
<tr>
<td>Minet-al-Bassal</td>
<td>10.46</td>
<td>—</td>
<td>0.08</td>
<td>0.14</td>
<td>0.20</td>
<td>0.15</td>
<td>0.12</td>
<td>0.02</td>
</tr>
<tr>
<td>Percentage Total</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

†Source: Egypt, The Census of Population, 1947, Table VI, p. 36.
Factor II for 1947 shows some contrasts between the two cities. While Factor II is highly defined by the Handicapped ratio and Demographic Density for Cairo, the same factor shows relatively loadings on Male Unemployment (+.64), Female Divorced (+.47), and Muslims (+.42). Ethnicity, as it pertains to the Muslim population in Alexandria, enters into the ecological structure of Cairo quite differently (+.16). It seems obvious that the Muslim population in Cairo is dispersed among residential areas which rank either low or high on Factor II. The negligible loadings of Male and Female Literacy for both Cairo and Alexandria would indicate that the highly disorganized slums tend to have a unique spatial character. These are spatially located in an area of transition as well as in the outskirts, which function as accommodation for rural migrants.

The marked contrast between the factor loadings on Factor II for the two cities is expressed by its relatively low coefficient of congruence (.84) as compared to Factor I for 1947 (.96).

Variables defining Factor III indicate that the factor loadings for both cities in 1947 are quite similar (the coefficient of congruence is .90). However, Variable 3 (Never-Married Males) shows high positive loadings (+.71) on this factor for Alexandria, but not for Cairo (+.21). Thus, we begin questioning Abu-Lughod's identification of this factor as "Male Dominance." The factor loadings on Factor III for Cairo do not support such identification. The special character of this factor in Alexandria emerges when we observe the high positive loadings on Variable 3, Single Males. This, in fact, is consistent with Variable 4, Single Females (+.47) in spite of its low loadings.
As shown in Table 7, the degree of similarity between Factor I, socioeconomic status for the two communities in 1960 is extremely high (.96), while the other two factors do not conform to the same degree of congruence of Factor I.

The sharpest contrast between the factor loadings on Factor I for 1960 is in the opposite signs of loadings for almost all of the variables. The explanation can be classified as the tracts which rank high (with the + sign) for Alexandria in 1960 are those tracts which are characterized by low socioeconomic groups. While all of the defining variables of Factor I in the two communities have produced similar loadings, it is evident that the Muslim population in Alexandria (+.82) is more associated with Factor I than the Muslim population in Cairo (-.56).

The second contrast between the two communities is the fact that Cairo enjoys a higher proportion of single males and females than Alexandria. This can be attributed to the fact that an emerging group of young educated persons from rural Egypt prefer to move to Cairo for better educational facilities and job opportunities.

Loadings on Factor II for 1960 show quite a few contrast between the two communities. Disorganized social areas are identified by three defining variables for Cairo: Demographic Density (+.72), Muslim population (+.55), and low loadings on Female Divorces (+.41). For Alexandria, loadings on the same factor are defined by a surplus of single males and females (+.74 for Males, and +.49 for Females), Demographic Density (+.54) and relatively low loadings on Females Divorced (+.45). Thus,
the identification of Factor II for Alexandria in 1960 as a "social disorganization" factor has to be revised. The factor loadings on Factor II for Alexandria indicate the high loadings of Single Males and Demographic Density explain the physical characteristics of the inner city slums. We say this because "social disorganization" is a very broad generalization and must be supported by more social and demographic variables.

Loadings on Factor III in 1960 also show some ecological contrasts between the two cities. This is supported by Table 8 where the coefficient of congruence for Factor III for the two communities is only .79. This factor shows little similarity between the two cities in contrast to Factor II which yields a coefficient of congruence of .96. This factor has been tentatively designated as a "male dominance" factor. While such identification might be true for Cairo, it does not seem to be for Alexandria. The loadings on this factor indicate that Cairo has a surplus of Males over Females, but for Alexandria, it is clear that the high factor loadings on Females Divorced (+.53) and the negatively significant loadings on Sex Ratio (-.89), indicate that this factor is a "female dominance" factor for Alexandria. This might also indicate a change in the position of females in Alexandria from total dependence on male support to a relative economic dependency. This argument can be best understood if we look at the factor loadings on Variable 9 (Females in School or Employed). For Cairo, the loadings on this variable is very low (.06), while for Alexandria it is relatively high (+.38).
In summary, the cross comparisons between the factor loadings on the three factors, over the decade under investigation, indicate the differences and similarities in the ecological structure of the two cities. We do not claim to have covered all of the possible differences and similarities by the cross comparisons, but the factorial typologies derived from the factor structure have enabled us, to some extent, to classify the residential areas in terms of their ecological factors.

In addition, we do not claim that the defining variables underlying the factors are the best to explain the temporal and spatial patterning of the ecological structure of Alexandria, due in part to a lack of census information.

Change Analysis of Alexandria, 1947-1960

The foregoing discussion has presented a cross-sectional analysis of the data by using factor analysis. This technique provides us with a static description of the underlying ecological structure of the city. Our findings have indicated that the City did not experience any drastic change over time. Coefficients of congruence (Table 7) indicate that Factor II, in particular, does show a low degree of similarity as compared to the other two factors. In our cross-comparison between Cairo and Alexandria, our findings indicate that Alexandria might have experienced some change between 1947 and 1960. Alexandria, as a developing city, may not coincide with other urban social structures. Other investigations have indicated that urban social structures do not change significantly during ten-year study periods.
We shall devote the following discussions to the underlying dimensions of change between 1947 and 1960.

All of the studies which have employed the social area change analysis attempted to examine the spatial patterning of social area indexes which vary systematically over time. In general, these studies have confirmed that social rank, family status, and ethnic status vary sectorally, concentrically, and in nucleation, respectively.

Our analysis of social area change in Alexandria between 1947 and 1960 is not directed toward this aim of providing the relative position of such a city on the scale of societal development. Our analysis will be directed toward presenting the changes that have occurred in the census tracts over a period of time.

The analysis has been made within the limitation of the data used for factor analysis. The standardized data for both years bined into one matrix with 13 variables and 170 observations; 85 census tracts for each year. Each census tract is represented by two values for each variable; one for 1947, the other for 1960. We have calculated the ratio of change by using the formula suggested by Brown and Horton.

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12L.A. Brown and F.E. Horton, ibid., p. 5.
This formula is presented in Chapter II of this paper. The ratio of change is used to remove the effects of census tract size.

A comparison is made between the Means and Standard Deviations of the thirteen variables for Alexandria in 1947 and 1960, after we calculated the ratio of change to show the nature of change on these variables. Table 10 shows the change dimensions between 1947 and 1960.

All variables show some kind of change except Sex Ratio, which has not changed and thus yields a zero of change ratio. Therefore, Sex Ratio had to be eliminated and the final analysis pertains only to 12 variables.

A factor analysis with a Varimax rotation is then performed on the combined data set. Three factors are extracted from the twelve variables. Table 11 shows the extracted three factors and the percentage of variance is explained.

The extracted dimensions clearly indicate some interesting variation in the ecological structure of the city which the cross-sectional examination failed to predict. Two kinds of change could be outlined: variability in family type, and variability in the social status factor.

The loadings on Factor I indicate that the defining variables are within the circle of family characteristics. Variable 2, Never-Married Males, and Variable 3, Never-Married Females show high and significant loadings as presented in Table 11; Variable 2 (-.98620), and Variable 3 (-.98703). The spatial distribution of factor scores, as well as the available demographic information on the tracts, provide us with meaningful

<table>
<thead>
<tr>
<th>Variables</th>
<th>1947</th>
<th>1960</th>
<th>Nature of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std.</td>
<td>Mean</td>
</tr>
<tr>
<td>1 Sex Ratio</td>
<td>104</td>
<td>10.8</td>
<td>102</td>
</tr>
<tr>
<td>2 Fertility Ratio</td>
<td>569</td>
<td>131</td>
<td>675</td>
</tr>
<tr>
<td>3 Males, Never Married</td>
<td>45.4</td>
<td>17.7</td>
<td>48.6</td>
</tr>
<tr>
<td>4 Females, Never Married</td>
<td>23.2</td>
<td>13.7</td>
<td>31.4</td>
</tr>
<tr>
<td>5 Females, Divorced</td>
<td>4.1</td>
<td>2.1</td>
<td>4.0</td>
</tr>
<tr>
<td>6 Persons per Room</td>
<td>2.1</td>
<td>0.5</td>
<td>2.2</td>
</tr>
<tr>
<td>7 Male Literacy</td>
<td>46.8</td>
<td>13.8</td>
<td>63.2</td>
</tr>
<tr>
<td>8 Female Literacy</td>
<td>23.2</td>
<td>16.4</td>
<td>35.5</td>
</tr>
<tr>
<td>9 Females, School/Employed</td>
<td>20.8</td>
<td>11.6</td>
<td>6.6</td>
</tr>
<tr>
<td>10 Handicapped</td>
<td>13.3</td>
<td>5.2</td>
<td>3.2</td>
</tr>
<tr>
<td>11 Males, Unemployed</td>
<td>5.5</td>
<td>3.5</td>
<td>4.8</td>
</tr>
<tr>
<td>12 Muslims</td>
<td>85.5</td>
<td>18.9</td>
<td>91.4</td>
</tr>
<tr>
<td>13 Density, Persons/ sq. kil.</td>
<td>80216</td>
<td>13337</td>
<td>105158</td>
</tr>
</tbody>
</table>

TABLE 11. Loadings on Twelve Variables Reflecting the Underlying Change Dimensions for Alexandria Between 1947 and 1960 (Orthogonal Rotation)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor I</th>
<th>Factor II</th>
<th>Factor III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Fertility Ratio</td>
<td>-.21382</td>
<td>(.79267)</td>
<td>-.09071</td>
</tr>
<tr>
<td>2 Males, Never Married</td>
<td>(-.98620)</td>
<td>.00241</td>
<td>.03815</td>
</tr>
<tr>
<td>3 Females, Never Married</td>
<td>(-.98703)</td>
<td>.01882</td>
<td>.02851</td>
</tr>
<tr>
<td>4 Females, Divorced</td>
<td>.07793</td>
<td>-.01882</td>
<td>-.19833</td>
</tr>
<tr>
<td>5 Persons per Room</td>
<td>.03159</td>
<td>-.16898</td>
<td>-.18841</td>
</tr>
<tr>
<td>6 Male Literacy</td>
<td>.11199</td>
<td>.00610</td>
<td>(.68052)</td>
</tr>
<tr>
<td>7 Female Literacy</td>
<td>.06437</td>
<td>.38511</td>
<td>.14228</td>
</tr>
<tr>
<td>8 Females/School</td>
<td>.01449</td>
<td>.26828</td>
<td>(.62722)</td>
</tr>
<tr>
<td>9 Males, Unemployed</td>
<td>.11021</td>
<td>.05244</td>
<td>(-.55864)</td>
</tr>
<tr>
<td>10 Handicapped</td>
<td>.07635</td>
<td>.40530</td>
<td>.13043</td>
</tr>
<tr>
<td>11 Muslims</td>
<td>-.01586</td>
<td>(.80781)</td>
<td>-.23479</td>
</tr>
<tr>
<td>12 Density</td>
<td>-.06173</td>
<td>-.15212</td>
<td>.32700</td>
</tr>
</tbody>
</table>

Cum. Percentage Variance Explained 17.3 31.4 43.5
and ready identification; Factor I is, thus, identified as the Familistic Coptic Factor. Such identification is facilitated by the negligible loadings on Variable 11, Percentage of Muslims in Tract (-0.01586), and the spatial distribution of the census tracts which rank high on this factor. The highest factor scores on Factor I are from four census tracts.

By looking at the actual data and the demographic characteristics of the population in these tracts, it has become evident to us that such identification is meaningful. To support this argument, an Index of Dissimilarity is computed to see to what extent these four tracts are dissimilar from the remaining metropolitan area in 1947 and 1960.

Table 12 shows the percentage distribution of population by religion. The Index of Dissimilarity ranges from zero to 100. The values are high when we compare the average for the whole metropolitan area for the major religious groups residing in each census tract. The Index was 5.5 for 1947 and became 6.2 in 1960. Table 12 also shows some degree of residential stability for the Coptics in Alexandria.

Factor II is identified as Familistic Muslims, which is defined by high positive loadings on two variables; Variable 1, Fertility Ratio, and Variable 2, Percentage Muslims. The factor loadings reflect positive association between the two variables (See Table 10). The tendency of Muslim families to have a high fertility ratio is supported by the demographic analysis of the Egyptian society. The loadings on Factor II also suggest that the Muslim population in Alexandria is dispersed spatially.
<table>
<thead>
<tr>
<th>Census Tract No.</th>
<th>Major Religions - 1947</th>
<th>Index of Dissimilarity</th>
<th>Major Religions - 1960</th>
<th>Index of Dissimilarity</th>
<th>Factor Scores on Factor I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Muslims</td>
<td>Copts</td>
<td>Others</td>
<td></td>
<td>Muslims</td>
</tr>
<tr>
<td>67</td>
<td>44.1</td>
<td>44.6</td>
<td>11.3</td>
<td>39.3</td>
<td>70.4</td>
</tr>
<tr>
<td>68</td>
<td>33.3</td>
<td>58.3</td>
<td>8.4</td>
<td>50.2</td>
<td>66.6</td>
</tr>
<tr>
<td>69</td>
<td>49.3</td>
<td>45.9</td>
<td>4.8</td>
<td>34.2</td>
<td>72.4</td>
</tr>
<tr>
<td>71</td>
<td>43.9</td>
<td>40.7</td>
<td>15.4</td>
<td>39.5</td>
<td>70.0</td>
</tr>
</tbody>
</table>
Thus, the factor loadings on Factor I and Factor II reflect variabilities in family types among the two major religious groups in Alexandria. We cannot claim, however, that family status in Alexandria is a major factor in residential choice as is the case in the ecological pattern of American cities. But, we can argue that in Alexandria there is a tendency toward family status factor to be emerged and separated from other underlying ecological factors of the city. This argument is consistent with what human ecologists have said in regard to the "necessary conditions" under which "familism vector to be either independent of, or coalesced with a socioeconomic vector." 13.

Abu-Lughod provides us with the necessary conditions needed for the family status vector:

...for our measures to identify a familism vector we require: (a) that family types vary, either to "natural" causes such as those associated with sequential stages in the family cycle, or to "social" causes such as those associated with other divisions in society, whether ethnic, socioeconomic or other; and (b) that subareas within the city be differentiated in their attractiveness to families of different types. 14

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13 See, for example, Abu-Lughod, "Testing the Theory of Social Area Analysis," op. cit., pp. 208-209; and Berry and Rees, op. cit., Table 2, p. 466.

14 Abu-Lughod, ibid., p. 208.
Thus, we can argue that the "necessary conditions" required for a Family-Status Factor, to some extent, have occurred during the decade under investigation for the following reasons: First, the Coptic family varies in terms of its size and cycle; second, the tracts which show considerably higher magnitudes on Factor I are located in the "better" areas in Alexandria. However, before we accept this argument one must establish the position of the Coptic as a minority group on the socioeconomic scale, the size of the Coptic family, portions of the age pyramid, and fertility, which are beyond the scope of this paper.

Factor III is classified as a Socioeconomic Status Factor. Three variables define this factor: Male Literacy (+.68052), Females in School or Employed (+.62722), and Males, Unemployed (-.55864). These factor loadings, however, do not suggest clear disassociation between social rank and family characteristics.

Thus, we cannot claim that variations have occurred over the decade under investigation regarding the socioeconomic factor, but there is an indication that Factor III is not loaded very high with ethnicity. The loadings on Variable 11, Percentage of Muslims, carry very low and negative loadings on Factor III (-.23479). Such identification, however, is a tentative one since the spatial distribution of factor scores for Factor III reflect many inconsistencies among almost all census tracts under investigation, especially when we carried on comparisons between the extracted Factor I for 1947 and 1960 data, and Factor III which reflects a change dimension.
In conclusion, our findings in this chapter support the fact that the use of factor structure as a model of ecological structure provides, as Frank L. Sweester has pointed out, an optimal method for systematic intra-national comparisons of the fundamental dimensions of residential area differentiation in urban and metropolitan communities.

Our first hypothesis proved to be true. Since the level of modernization in Egypt is not equal to that of the United States, we would not expect as great a factorial separation of social area variables for Alexandria as is found for United States and Canadian cities.
CHAPTER V

THE RESIDENTIAL DISTRIBUTION OF MAJOR STATUS GROUPS
IN ALEXANDRIA

In the present chapter we shall confine our attention to the problem of residential distribution of major religious and status groups in Alexandria. The main focus of this chapter is to determine to what extent these groups are residentially segregated from each other. The answer to this question, in fact, will serve as a useful reflection of Alexandria's social structure which, in turn, is a function of the level of industrial development of the city.

So far, urban ecologists have taken account of the tendency of people to select residential sites in cities on the basis of racial, cultural, religious, or ethnic preferences to choose residential locations that are symbolic of wealth, power, or social prestige. Current research has revealed the fact that differences of social class, religion, and ethnic origin are among the major factors that have the greatest impact on the city's spatial structure.

The ecological analysis in this regard is aimed at determining the pattern of residential segregation of status groups from each other and their differential distribution in urban residential space.

Research on U.S. cities has indicated that the spatial location among status groups parallel their social distance. The generalizations in this respect have achieved their empirical validity. An initial and important study by Duncan and Duncan reveals that:

...spatial distances between occupation groups are closely related to their social distances, measured either in terms of conventional indicators of socioeconomic status or in terms of differences in occupational origins; that the most segregated occupation groups are those at the extremes of the socioeconomic scale; that concentration of residence in low-rent areas is inversely related to socioeconomic status; and the centralization of residence is likewise inversely related to socioeconomic status.2

There has, of course, been a long tradition of research by human ecologists in the U.S. dealing with the segregation of urban status groups. Empirical investigations have confirmed that groups of similar socioeconomic status will have similar residential patterns; and, as the status level widens, location of residence will become increasingly dissimilar.3 With relation to the spatial location of social status groups, human ecologists have indicated that poorly-educated and low-income groups frequently have been found to be over-represented among the residents of the central city in metropolitan areas, and higher status groups tend to reside in the suburbs.4


Working primarily on data for American cities, human ecologists have studied the relationships between social correlations such as income, occupation, race, and ethnic background, and residential segregation. For example, Duncan and Duncan in their study on "Residential Distribution and Occupational Stratification," have demonstrated that occupational groups in Chicago vary in the degree of residential segregation from one another. Wilkins\(^5\) has reached the same conclusions in a study on the residential distribution of occupation groups in some middle-sized cities in the United States.

Lieberson has studied the assimilation rates for a number of cities. He found a consistent association through time between residential desegregation of an ethnic group and increasing socioeconomic similarity to native whites.\(^6\)

\(^4\) Leo F. Schnore, The Urban Scene (New York: The Free Press, 1965)


Karl and Alma Taeuber, and Clemence have concluded, by observing census information for large American cities, that Negro areas are becoming more racially distinct and the general trend, in relation to Negro residential patterns, is toward polarization rather than dispersion of the nonwhite population.\(^7\)

Research on dissimilarity and segregation in residential distribution in U.S. cities has shown that the degree of residential segregation among status groups is inversely related to appropriate indicators of their socioeconomic status and their social distance from each other.

Comparative studies on the subject have shown that the spatial segregation of population types is a function of the degree of modernization and differentiation within a society. Recently, Mehta has made some tentative, general observations in relation to such types of spatial segregation:

1. The phenomenon of residential dissimilarity between groups, whether religious, ethnic, racial, caste, occupation, or other is universal, and tends to increase with increasing disparity between the groups' socioeconomic status or prestige ranking.
2. The phenomenon of residential segregation of groups is universal and the segregation curve which emerges when groups are ranked high to low on the same socioeconomic scale is characteristically "U"-shaped.

3. Processes of modernization and industrialization have little or no impact on the above two phenomenon.

4. Differential residential centralization (or decentralization) of groups is universal. In pre-industrial cities, in cities that had become relatively large before modern developments in transportation, particularly the automobile, and in communication had taken place, higher status groups tend to be centralized, and the lower-status groups tend to be decentralized. In those cities which grew recently and along with improvements in transportation and communication, the situation is reversed; the privileged groups are decentralized, and the poor are centralized.

5. Those who are highly centralized are highly segregated, in each case because of either poverty or riches; those who are highly decentralized are also highly segregated, and again they are so because of either poverty or riches.

6. Those who are neither centralized nor decentralized are not highly segregated, in each case because of lack of poverty or riches. 8

To deal with the residential distribution of status groups in Alexandria, a number of propositions are drawn upon:

1. There is a difference in the residential distribution of social groups in Alexandria.

2. The residential dissimilarity between status groups reflect the social distance among them.

3. Religion is one of the factors which underly the residential patterning among social groups in Alexandria.

---

4. The pattern of centralization among status groups is typical to that of modernizing cities with the highest status groups most centralized and the low status groups the most decentralized.

The analysis is carried out using indexes of dissimilarity, segregation, and centralization which were initially suggested by Duncan and Duncan, using data from the census bulletins for the city of Alexandria for 1960.

In delineating the residential areas for the study, 98 census tracts were selected; 18 census tracts were excluded because they are located in fringe areas with a large concentration of agricultural activities.

The variables selected for final analysis are: Occupation, Education, and Religion. Unfortunately, the distribution of population by income is unavailable in the Egyptian Census. However, occupation and education are sensitive indicators of the social status distribution of groups in the Egyptian society.

Patterns of Residence: Dissimilarity, Segregation and Centralization

The theoretical assumptions underlying the use of indexes of dissimilarity in residential distribution imply that as socioeconomic differences increase, so too, does the degree of residential dissimilarity. As far as residential dissimilarity among occupational groups goes, the dissimilarity values tend to increase as we move from the top professions to those at the bottom. The values should increase from left to right.
In regard to patterns of segregation, the values follow a "U" shaped curve. That is, the highly segregated groups would be the people at the two extremes. The index of centralization ranges from +100 to -100; positive values indicating a tendency for location toward the center and negative values indicating the reverse. These trends are shown in Table 13.

We have used the ranking of occupational categories as reported in the census which reflects, in a general way, the hierarchy of occupational status in the Egyptian society. We do not claim, however, that such hierarchy is supported by empirical investigation. Unfortunately, Service and Entertainment workers are grouped together in the census. Personal Service includes such occupations as maids, domestic servants, housekeepers, waiters, and barmen. Thus, Category 7 includes the entertainment workers such as night club singers, dancers, etc., along with service workers. Accordingly, any statistical values in relation to this occupational category may produce dubious results.

The index of dissimilarity values support the first proposition stated above, that the occupational groups in Alexandria have dissimilar residential distributions. The values indicate that the index value is 48 between technical-professionals and laborers (Artisans and Craftsmen), and it is the same value (48) between Executive-Managers and Laborers. The index value for Professionals and Managers is only 10.

If increasing social distance is paralleled by increasing dissimilarity in residential location, we can argue, then, that the findings support this argument. However, service and entertainment occupations
### TABLE 13

Indexes of Dissimilarity, Segregation, and Centralization for Major Occupational Groups of Total Employed 15 Years and Above, Alexandria, Egypt, 1960

<table>
<thead>
<tr>
<th>Major Occupation Groups</th>
<th>Index of Dissimilarity</th>
<th>Percentage of Segregation</th>
<th>Centralization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1  2       3    4        5    6    7</td>
<td>8         9</td>
<td></td>
</tr>
<tr>
<td>Technical-Professional</td>
<td>10 19 42 41 48 29 45</td>
<td>5.55 53</td>
<td>-12</td>
</tr>
<tr>
<td>Executive-Managerial</td>
<td>19 41 41 48 28 46</td>
<td>2.82 52</td>
<td>-15</td>
</tr>
<tr>
<td>Clerical Office</td>
<td>25 25 32 18 29 47</td>
<td>10.06 47</td>
<td>+6</td>
</tr>
<tr>
<td>Sales and Commerce</td>
<td>16 14 18 18 14.15 40</td>
<td>6.06 40</td>
<td>+12</td>
</tr>
<tr>
<td>Transportation &amp; Communication</td>
<td>14 20 16 5.66 39</td>
<td>5.66 39</td>
<td>+7</td>
</tr>
<tr>
<td>Artisan &amp; Craftsmen</td>
<td>25 14 38.44 52</td>
<td>52</td>
<td>+9</td>
</tr>
<tr>
<td>Service &amp; Entertainment&lt;sup&gt;c&lt;/sup&gt;</td>
<td>26 17.50 48</td>
<td>48</td>
<td>-16</td>
</tr>
<tr>
<td>Unprod. Occupations</td>
<td></td>
<td>5.82 41</td>
<td>+1</td>
</tr>
</tbody>
</table>

\[N = 348,396\] 100.00


<sup>b</sup>Does not include Agriculture, Fishing and Mining Occupations. Statistical analysis based only on data for 98 census tracts.

<sup>c</sup>Service and entertainment workers are grouped together in the census.
provide striking exceptions. We believe that this might be due to the error in combining these two different occupational categories together.

From the indexes of segregation for major occupational groups, it is apparent that Technical-Professional, Executive-Managerial, and Artisan and Craftsmen are the most segregated groups in Alexandria. Transportation and Communication occupations yield the least degree of residential segregation.

While the values of segregation are relatively close in their magnitudes, the findings still support the idea that the groups who are at the top and the bottom of the occupational hierarchy are the most segregated groups.

The centralization values indicate that Professional and Managerial occupations tend to be decentralized in relation to the city center. These findings are not, however, surprising for two reasons. First, the city's expansion has recently been toward the east, especially along the shore of the Mediterranean Sea. The upper and middle classes are mostly located in el Ram1 (Ramleh, see Map 2). Second, the University of Alexandria is located in the East at el Shatbi, which is located only a short distance from the center of the city.

The highly centralized groups in Alexandria are among sales and commerce workers, transportation workers, and artisan and craftsmen. The index of centralization for service and entertainment workers yields a value of -16, which indicates that this group is highly decentralized. This result, however, seems to be a dubious one as indicated before and should be disregarded in our analysis.
Our findings do not, however, support the fourth proposition and indicate that the highest occupational groups are decentralized and the middle and lower occupational groups are centralized. This might reveal the stage of development of Alexandria, which has experienced a rapid growth and development in recent years.

In the distribution of residential areas according to educational attainment of the population, the dissimilarity values seem to indicate different patterns. It can be seen in Table 14 that the various educational groups have a dissimilar residential pattern. The first three categories, Illiterate, Barely Reads, and Reads and Writes, are for those who have not attended formal schools. Those who can read and write are most likely to have learned through informal education, or, at least have spent some time in schools and then dropped out later. Formal schooling is obligatory for children six years of age. After spending six years in Elementary School, the person has to be enrolled in the Preparatory Schools, where he spends three more years. After passing a national contest, the student is then admitted either to general high schools or vocational training schools. To get a college degree requires at least four academic years.

The index of dissimilarity values indicate that there is a distinct place, educationally, in the system of Egyptian urban areas. The most segregated groups are those with a college education and those with no years of formal schooling.

The index of segregation values also support this previous finding. The most segregated groups are among those who have received

<table>
<thead>
<tr>
<th>Major Educational Groupsb</th>
<th>Index of Dissimilarity</th>
<th>Percentage of total</th>
<th>Segregation</th>
<th>Centralization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Illiterate</td>
<td>28 16 32 37 41 59</td>
<td>48.22</td>
<td>30</td>
<td>-2</td>
</tr>
<tr>
<td>2. Barely Reads</td>
<td>30 37 39 42 57</td>
<td>1.26</td>
<td>29</td>
<td>16</td>
</tr>
<tr>
<td>3. Reads &amp; Writes</td>
<td>20 23 27 45</td>
<td>35.92</td>
<td>15</td>
<td>-2</td>
</tr>
<tr>
<td>4. Elem. Education</td>
<td>11 18 32 35.92</td>
<td></td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>5. Completed Intermed.</td>
<td>12 26 8.90 30</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6. Went Beyond Intermed.</td>
<td>31 0.24 31</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7. College or Higher</td>
<td>1.94 46 1.94</td>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

N = 1,025,953  100.00

Source: Census of The United Arab Republic, 1960, op. cit., Table XV, pp. 70-85.

Some categories are combined because of small numbers, and the statistical analysis is based on data for 98 census tracts.
college education. However, inconsistencies are reported in Table 14 for those who have no formal years of schooling (Illiterates) and for those who have completed high school. The index values for both groups is 30. The index values suggest that the patterns of residential distribution for those who have a college degree are distinct and clear. The segregation index for educational groups follows a "J" shaped curve instead of the usual "U" shaped curve supported in other investigations.

The index of centralization values indicate that those who have completed their college education are the decentralized groups in Alexandria. This is also supported by the index of centralization for professionals and managers as shown in Table 13. The index values for illiterates is -2. This might be best explained by the fact that the percentage of illiterates is 48.2, and thus, the illiterates are most likely to be residentially dispersed all over the city.

The differences in residential distributions for the major religious groups in Alexandria is presented in Table 15. The index values indicate both Jews and foreign Christians have a distinct residential location. The Muslims and the Coptics seem to be comparatively the same in their residential patterns. The values for Muslims and Jews, and Muslims and other Christian groups are 75 and 79, respectively.

The index of segregation values also indicates that the degree of residential segregation for both Muslims and Coptics is relatively close in comparison to other religious groups. However, the Coptics and the Jews are most likely to be linked in their places of residence. This is supported by looking at the index of centralization values for
TABLE 15. Indexes of Dissimilarity, Segregation, and Centralization for Major Religious Groups, Alexandria, Egypt, 1960*

<table>
<thead>
<tr>
<th>Major Religious Groups**</th>
<th>Index of Dissimilarity</th>
<th>Percentage of Segregation</th>
<th>Centralization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Muslims</td>
<td>46 75 79 89.26 50</td>
<td>-33</td>
<td></td>
</tr>
<tr>
<td>2. Coptics ***</td>
<td>49 56 10.52 45</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3. Jews</td>
<td>38 0.19 72 24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Others ****</td>
<td>0.03 76 -12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 1,439,288 100.00

*Source: Census of The United Arab Republic, 1960, op. cit., Table XII, pp. 34-38.

**Statistical analysis is based on data for 98 census tracts.

***Coptics are Egyptian Christians and are classified in the Census into three categories: Orthodox, Protestants, and Catholics.

****Mostly are Christians foreign-born or first generation and are classified in the Census into three categories: Orthodox, Protestants, and Catholics.

both Coptics and Jews, which suggests that these two religious groups live close to the city center.

The degree of segregation for all religious groups indicates that the most segregated religious groups are both the Jews and the Foreign Christians. These Christians, though, are decentralized in their residential location. The segregation values follow a "J" shaped curve.
As far as residential distribution for the major religious groups in Alexandria goes, certain aspects of segregation by ethnic groups of preindustrial cities are characterized in present-day Alexandria. Sjoberg has described this segregation:

Segregation by ethnic groups ... occurs widely in preindustrial cities. The Jews in Europe have had their well-defined ghettos, persisting in some locales well into the twentieth century, and Jewish quarters have long been part of the urban scene throughout the Middle East. Ethnic quarters tend to be self-sufficient entities to the extent that urban living allows, physically and socially, the separation from the rest of the community. 9

Our findings, then, support the third proposition that religion is expected to be one of the factors which underlie the residential distribution in Alexandria.

The material we have presented may be more meaningful if we look at some of the features of the geographical distribution of the occupational groups. This is done because we want to know to what extent occupational status is effective as a determinant of residential location.

We have followed the method suggested by Collison10 in dividing the city into sector-zone segments. The division of the city into four major sectors and nine zones is suggested by its geographical and typographical pattern as shown in Map 1.


10Peter Collison, "Occupation, Education, and Housing in an English City," op. cit., pp. 595-596.
The data presented in Table 16 require detailed comments. While Professionals and Managers are highly segregated and decentralized in the whole metropolitan area, some variations do occur when checking their distribution by zones and sectors. In the Northeastern section of the city, both groups hold a high degree of residential segregation. However, the degree of residential centralization differs. As shown in this table, Technical Professionals are most likely to be centralized in this area, while the Executive-Managerial group is decentralized. The same variation carried by the index of centralization values is apparent. In the southeastern section of the city both groups are decentralized and Executive-Managerial groups are highly segregated in this area. Data for service and entertainment workers' residential patterns indicate that they are decentralized in the Northeast, Southeast, and Southwest sections of the city, except in the Northwest section. The central city is located in the Northwestern section. Thus, many of the service and entertainment workers seem to like to reside near the center of the city. Some members of this category, such as hotel servants, live at their place of work.

The data in Table 16 suggest, therefore, that the Technical-Professional and Executive-Managerial groups, who are considered to be at the top of the occupational hierarchy, are dissimilar or differentiated from the other groups in their residential patterns. However, differences in skills do not seem to produce very much differentiation. In fact, to determine just how effective the occupation status is as a determinant in residential location, an analysis of housing characteristics, rental values as well as income must be incorporated. At this time, data are unavailable for this variable.
TABLE 16. Indexes of Segregation and Centralization for Major Occupational Groups for the Whole Metropolitan Area by Zone-Sector Segments, Alexandria, 1960

<table>
<thead>
<tr>
<th>Major Occupational Groups</th>
<th>Metropolitan Area</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tech-Professional</td>
<td>53</td>
<td>-12</td>
<td>40</td>
<td>+5</td>
<td>38</td>
</tr>
<tr>
<td>Exec-Managerial</td>
<td>52</td>
<td>-15</td>
<td>49</td>
<td>-11</td>
<td>52</td>
</tr>
<tr>
<td>Clerical Office</td>
<td>47</td>
<td>+6</td>
<td>53</td>
<td>+39</td>
<td>45</td>
</tr>
<tr>
<td>Sales &amp; Com.</td>
<td>40</td>
<td>+12</td>
<td>27</td>
<td>+39</td>
<td>47</td>
</tr>
<tr>
<td>Trans. &amp; Comm.</td>
<td>39</td>
<td>+7</td>
<td>35</td>
<td>+13</td>
<td>37</td>
</tr>
<tr>
<td>Artisans &amp; Craft.</td>
<td>52</td>
<td>+9</td>
<td>36</td>
<td>+46</td>
<td>46</td>
</tr>
<tr>
<td>Ser. &amp; Enter.</td>
<td>48</td>
<td>-18</td>
<td>35</td>
<td>-12</td>
<td>40</td>
</tr>
<tr>
<td>Unskilled</td>
<td>41</td>
<td>+1</td>
<td>33</td>
<td>+37</td>
<td>41</td>
</tr>
</tbody>
</table>
The Spatial Distribution of Social Status Characteristics

At this point in our analysis, it is necessary to examine the spatial distribution of the social status characteristics in Alexandria. Such a determination must be made if we are to find the clues to the aggregate social structure of the city. Residential location reveals the effects of social structure. 11

To examine the spatial distribution of the social status characteristics, we have employed the same data: Occupation, Education, and Religion. Such spatial distribution involves a two-way analysis of variance for a selected 36 census tracts. We divided the city into four major sectors and nine zones as mentioned in Chapter II of this study (see Map 1). Then, we randomly selected 36 census tracts extending from the city's center to the periphery. However, those sectors in the fringes with a high proportion of agricultural activities are excluded from the analysis.

Nine zones are selected from each sector: one which is next to the city's center, then, one for each mile up to the third zone, then another census tract for every three miles up to the ninth census tract. In the Westward Section, only seven zones could be retained for final analysis.

Table 17 shows the spatial distribution of the occupational variables which reflect the "style of life," or the socioeconomic characteristics.

TABLE 17. Percentage of the Total Sum of Squares Explained by Sector and Zone for All Occupational Groups, Alexandria, 1960

<table>
<thead>
<tr>
<th>Major Occupational Groups</th>
<th>Technical</th>
<th>Executive</th>
<th>Clerical</th>
<th>Sales</th>
<th>Trans.</th>
<th>Artisans</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Professional</td>
<td>Managerial</td>
<td>Office</td>
<td>Commerce</td>
<td>Communication</td>
<td>Crafts.</td>
<td>Enter.</td>
</tr>
<tr>
<td>Sector</td>
<td>23.77*</td>
<td>25.10*</td>
<td>18.02</td>
<td>12.54</td>
<td>11.2</td>
<td>14.7</td>
<td>15.66</td>
</tr>
<tr>
<td>Zone</td>
<td>35.22</td>
<td>29.00</td>
<td>28.05</td>
<td>30.56</td>
<td>26.8</td>
<td>26.01</td>
<td>36.73*</td>
</tr>
</tbody>
</table>

*This symbol indicates that the percentage of the sum of the squares is statistically significant beyond the .05 level. The test of significance is the two-way analysis of variance.

TABLE 18. Percentage of the Total Sum of Squares Explained by Sector and Zone for All Educational Groups, Alexandria, 1960

<table>
<thead>
<tr>
<th>Major Educational Groups</th>
<th>Illiterate</th>
<th>Barely Reads</th>
<th>Reads Writes</th>
<th>Elem. Ed. 4 Years</th>
<th>Comp. Int. 9 years</th>
<th>Beyond Inter.</th>
<th>College or 13 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector</td>
<td>8.68</td>
<td>8.68</td>
<td>21.41</td>
<td>30.90*</td>
<td>33.67</td>
<td>21.40</td>
<td>47.54</td>
</tr>
<tr>
<td>Zone</td>
<td>23.70</td>
<td>24.30</td>
<td>18.32</td>
<td>16.41</td>
<td>19.62</td>
<td>22.61</td>
<td>18.40</td>
</tr>
</tbody>
</table>

*This symbol indicates that the percentage of the sum of the squares is statistically significant beyond the .05 level. The test of significance is the two-way analysis of variance.
The data suggest that the higher socioeconomic groups, as reflected in the occupational hierarchy of the city, are neither distributed primarily by sector or zone. This finding may highlight the data presented in Table 13 in relation to the residential location of the higher status groups. There is no indication that there is a spatial gradient for the higher status groups from the city center to the periphery. Thus, the higher status groups and the middle status groups live within the city. The data also suggest that service workers are spatially distributed by the distance gradient. Probably service workers in Alexandria come from satellite agricultural communities in the periphery to work in the city but live outside.

Data presented in Table 18 suggest that middle and higher educational groups are sectorally distributed and live within the city. Table 19 indicates that both Jews and Foreign Christians are spatially distributed in sectors rather than in zones. The percentage of the total sum of squares for Muslims suggests a gradient pattern, yet it lacks statistical significance. However, it does indicate that Muslims are most likely to be residentially dispersed within the city and toward the periphery.

These findings only reveal the spatial patterning of residential location for the major status and religious groups in Alexandria. Our analysis for the spatial distributions of the occupational, educational and religious variables does not, in fact, provide us with a clear mapping of our data. Such mapping, we believe, should enable us to depict the
aggregate social structure of the city. Thus, the question which has yet to be answered is: Where are these major status groups located?

The answer to this principal question in our study may enable us to map the social characteristics together by employing the Centrographic technique to produce their spatial configuration. This is the focus of our next chapter.

TABLE 19. Percentage of the Total Sum of Squares Explained by Sector and Zones for All Religious Groups, Alexandria, 1960

<table>
<thead>
<tr>
<th>Major Religious Groups</th>
<th>Muslims</th>
<th>Coptics</th>
<th>Jews</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector</td>
<td>8.73</td>
<td>37.85</td>
<td>32.85*</td>
<td>44.35*</td>
</tr>
<tr>
<td>Zone</td>
<td>20.32</td>
<td>15.95</td>
<td>17.21</td>
<td>18.08</td>
</tr>
</tbody>
</table>

*This symbol indicates that the percentage of the sum of the squares is statistically significant beyond the .05 level. The test of significance is the two-way analysis of variance.
CHAPTER VI
THE SPATIAL DISTRIBUTION OF STATUS AND RELIGIOUS GROUPS
IN ALEXANDRIA

Accretions to knowledge from the study of spatial distribution
of human population are valuable for ecological generalizations in rela-
tion to urban social structure. Human ecologists, so far, have been con-
cerned with the spatial distribution of the social characteristics of
the population over space. Most of the ecological investigations employ,
as Beshers points out, mapping techniques to reveal the spatial distribu-
tion of social characteristics. Beshers provides us with summary descrip-
tions of importance and the problems involved in using these techniques
in the ecological analysis:

[The] problem is to describe the spatial distribution
of the social characteristics of cities. The regular-
ities of the spatial distribution provide clues to the
aggregate social structure of the city. Of course,
there is much more to urban social structure than can
be revealed on maps, especially maps of census data
only. But if there is any aggregate, overall urban
social structure, its effects should be revealed in
spatial regularities...residential location should
reveal the effects of social structure. The "style
of life" of a person, the income of a person, and the
prejudices of a person are all reflected in the choice
of dwelling....

The human populations, as most urban ecologists and urban
geographers believe, can be located by their residence, their places of

work, or by some other activity they engage in. Much of the efforts of ecologists have been directed toward developing special kinds of techniques to deal with this problem. Many of these techniques are readily adapted to the measurement of distribution of population. Recently, a set of techniques called centrographic measures proved to hold a great deal of promise in analyzing areal data.

The focus of the present chapter is to apply a set of centrographic measures to locate the major status and religious groups in Alexandria and to indicate their relationships to each other in space over time. A number of propositions are drawn upon to deal with this problem:

1) That there is variation in the location of status groups over time.
2) As the city grows in size, the mean center of the total population will indicate some change.
3) That the location of the higher socio-economic groups is most likely to indicate a migratory stream toward the periphery.

Data and Analytic Procedures

As indicated in Chapter II of this study, an attempt was made within the limitations of the data, to use the same variables in each of the three analyses. There is, however, other information regarding National Origin and Religion for 1966 which are to be included in the present analysis. Comparisons between 1947 and 1966 are, thus, possible for National and Religious groups.

\[O.D.\ \text{Duncan,} \ \text{Statistical Geography, op. cit., p. 81.}\]

\[D Douglas B. Lee, \ \text{Analysis and Description of Residential Segregation, op. cit., p. 5.}\]
This analysis pertains to the whole metropolitan area from 1947 to 1966. The number of census tracts, however, vary from year to year. For 1947, 95 census tracts are selected; for 1960 and 1966, the number has been increased to 115 due to changes in the boundaries of the metropolitan area.

The census tract is used as the unit of analysis. A large census tract map (1:25,000) for the city has been prepared for the three years, indicating the expansion along the X and Y coordinates with a scale of 4 inches equals one mile. This map was then reduced by 25% for publication in this paper.

The procedure to determine the center of the location of census tract population, as suggested by Lee, was used. Using the centroid of the tract as the center of gravity assumes that the population is uniformly distributed over the tract, or distributed in some other way, resulting in the center of an area coinciding with the center of gravity.

An Interpretation of the Information Yielded by the Measures

The measures selected for the final analysis are: the Mean Center, the Standard Radius, and the Coefficient of Circularity (described in detail in Chapter II). These measures are computed by using a computer program developed by J.F. Hultquist from the Department of Geography, The University of Iowa. The output from the program includes statistical descriptions of the centers of the total population, all census tracts in the city, and the location of the major occupational, educational, 

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4Lee, ibid., p. 54.
religions and national groups. This information is plotted graphically to determine the center of various groups for one point of time, and through several points in time for a given group.

In order to determine how much the group is spread out, the standard radius is to be computed. However, Lee points to some difficulties in relation to the interpretation of the magnitude of the standard radius. The magnitude is influenced by relative dispersion, size of the group, shape of the area, and the size of the area. Thus, if the group is large and if the actual size of the area under investigation is large, due to the location of some members of the group near the edges, this will necessarily increase the standard radius. He suggests, then, that the relative standard radius be computed by taking the ratio of the standard radius of the group to that of the total population:

If the standard radius of the group was the same as that of the total population, then the relative standard was one. If it was low, then the group was relatively more clustered and if the relative standard was greater than one, the group was more dispersed than the total population.7

To determine the center of the location of the group, the direction of its dispersion, and the shape and extent of the dispersion, the coefficient of circularity is suggested.8 This could be determined by visual comparisons, using the standard ellipse which is uniquely

5 Ibid., p. 60.

6 Ibid., p. 62.

7 Ibid., p. 66.
determined by two standard radii along the major and minor axes of the ellipse.

Such an ellipse is, in Lee's point of view, a complete summary of all the measures used.

**Movements of the Center of the Total Population**

Table 2 shows that the mean center of the total population does show some changes over time as indicated by the X and Y coordinates. The data for Table 21 are plotted in Figure 3, which shows different ellipses for the period under investigation. The heavy ellipse for 1947 and the lighter ones are for 1960 and 1966. The lines are the principal axes for each ellipse and the intersection of the axes is the center of the population in a given year.

The data suggest that the population of Alexandria were more clustered in 1947, but it has spread out in the last decade. The relative standard distance also supports this conclusion, which indicates the dispersion of the population over space.

Further support for this conclusion is provided by the percentage of the population living within 2 miles of the center of the city. For 1947, nearly 51.8% of the population was living within two miles of

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean Center X</th>
<th>Mean Center Y</th>
<th>Standard Distance At Major Axes</th>
<th>Standard Distance At Minor Axes</th>
<th>Standard Radius Orienta. Mode</th>
<th>Angles Nec. Rota. Rota.</th>
<th>Coefficient of Circularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>7.520</td>
<td>2.064</td>
<td>2.539</td>
<td>0.654</td>
<td>2.622</td>
<td>11.317</td>
<td>3.069 175.823</td>
</tr>
<tr>
<td>1960</td>
<td>8.634</td>
<td>1.872</td>
<td>3.716</td>
<td>0.671</td>
<td>3.776</td>
<td>12.838</td>
<td>3.102 177.752</td>
</tr>
<tr>
<td>1966</td>
<td>8.665</td>
<td>1.846</td>
<td>3.881</td>
<td>0.648</td>
<td>3.935</td>
<td>12.923</td>
<td>3.102 177.735</td>
</tr>
</tbody>
</table>
FIGURE 3. STANDARD ELLIPSES OF THE TOTAL POPULATION, ALEXANDRIA, 1947-1966
In 1960 there was only 38.9% as compared to 38.7% in 1966. This may indicate a recent process of suburbanization which has occurred in Alexandria during the 50's. The low magnitude of the coefficient of circularity may be understood by knowing the effects of the location of the city between the Sea in the north and Lake Mariute in the south, which limit its potential growth, except eastward or westward. The only open spaces available for the city for potential expansion are in the southeast and southwest. Between 1947 and 1960, however, the city center has moved toward the northeast and southeast. This is indicated by the ranges which occurred in the X and Y coordinates presented in Table 1. It is predicted that the city will expand further in the same direction in the future.

The Occupational Groups

Table 21 shows the centrographic measures for occupational groups for 1947 and 1960. The incomparability between the occupational categories between the two years did not allow us to present an overall comparison of the occupational structure for both years. However, we were able to carry on some comparisons of the relationship between Professionals, Managers, Personal Service and Craftsmen in space. Since the measures are standard, the size of the occupational groups would not have any effect upon the ellipses.

In 1947, all the occupational groups have varied standard radii. The most dispersed groups are agricultural workers, clerical-office workers, and construction workers. The most clustered group is in
<table>
<thead>
<tr>
<th>Occupation Groups</th>
<th>Mean Center X</th>
<th>Mean Center Y</th>
<th>Standard Distance Major Axes</th>
<th>Standard Distance Minor Axes</th>
<th>Standard Radius Orienta. Std.</th>
<th>Mode</th>
<th>Angles ° Nec. Rota.</th>
<th>Rota.</th>
<th>Coefficient of Circularity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1947</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tot. Pop.</td>
<td>7.520</td>
<td>2.064</td>
<td>2.539</td>
<td>0.654</td>
<td>2.623</td>
<td>11.317</td>
<td>3.069</td>
<td>175.823</td>
<td>0.257</td>
</tr>
<tr>
<td>Agriculture</td>
<td>9.955</td>
<td>1.738</td>
<td>3.860</td>
<td>0.590</td>
<td>3.904</td>
<td>13.916</td>
<td>3.072</td>
<td>176.035</td>
<td>0.153</td>
</tr>
<tr>
<td>Manufacture</td>
<td>7.219</td>
<td>2.114</td>
<td>2.219</td>
<td>0.688</td>
<td>2.323</td>
<td>10.830</td>
<td>3.042</td>
<td>174.298</td>
<td>0.310</td>
</tr>
<tr>
<td>Construc.</td>
<td>7.850</td>
<td>1.939</td>
<td>2.734</td>
<td>0.641</td>
<td>2.808</td>
<td>11.804</td>
<td>3.089</td>
<td>176.616</td>
<td>0.234</td>
</tr>
<tr>
<td>Transport.</td>
<td>6.916</td>
<td>2.118</td>
<td>2.217</td>
<td>0.695</td>
<td>2.324</td>
<td>10.709</td>
<td>3.069</td>
<td>175.829</td>
<td>0.314</td>
</tr>
<tr>
<td>Commerce</td>
<td>7.362</td>
<td>2.129</td>
<td>2.267</td>
<td>0.642</td>
<td>2.356</td>
<td>11.037</td>
<td>3.058</td>
<td>175.235</td>
<td>0.283</td>
</tr>
<tr>
<td>Pers. Serv.</td>
<td>7.535</td>
<td>2.105</td>
<td>2.452</td>
<td>0.662</td>
<td>2.540</td>
<td>11.266</td>
<td>3.064</td>
<td>175.537</td>
<td>0.270</td>
</tr>
<tr>
<td>Social Ser.</td>
<td>7.766</td>
<td>2.166</td>
<td>2.590</td>
<td>0.689</td>
<td>2.680</td>
<td>11.551</td>
<td>3.074</td>
<td>176.128</td>
<td>0.266</td>
</tr>
<tr>
<td><strong>1950</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tot. Pop.</td>
<td>8.634</td>
<td>1.872</td>
<td>3.716</td>
<td>0.674</td>
<td>3.773</td>
<td>12.838</td>
<td>3.102</td>
<td>177.752</td>
<td>0.181</td>
</tr>
<tr>
<td>Profess.</td>
<td>8.978</td>
<td>1.834</td>
<td>3.102</td>
<td>0.601</td>
<td>3.248</td>
<td>13.131</td>
<td>3.126</td>
<td>179.108</td>
<td>0.188</td>
</tr>
<tr>
<td>Managers</td>
<td>9.099</td>
<td>1.836</td>
<td>3.265</td>
<td>0.565</td>
<td>3.314</td>
<td>13.295</td>
<td>3.133</td>
<td>179.532</td>
<td>0.173</td>
</tr>
<tr>
<td>Clerical</td>
<td>8.433</td>
<td>1.879</td>
<td>3.217</td>
<td>0.632</td>
<td>3.278</td>
<td>12.576</td>
<td>3.112</td>
<td>178.320</td>
<td>0.193</td>
</tr>
<tr>
<td>Commerce</td>
<td>8.074</td>
<td>1.925</td>
<td>3.309</td>
<td>0.650</td>
<td>3.372</td>
<td>12.190</td>
<td>3.096</td>
<td>177.416</td>
<td>0.196</td>
</tr>
<tr>
<td>Constr.</td>
<td>11.334</td>
<td>1.625</td>
<td>5.348</td>
<td>0.718</td>
<td>5.396</td>
<td>15.934</td>
<td>3.129</td>
<td>179.277</td>
<td>0.134</td>
</tr>
<tr>
<td>Crafts.</td>
<td>6.368</td>
<td>0.802</td>
<td>3.680</td>
<td>0.815</td>
<td>3.769</td>
<td>8.568</td>
<td>0.088</td>
<td>150.060</td>
<td>0.222</td>
</tr>
<tr>
<td>Service</td>
<td>8.068</td>
<td>1.954</td>
<td>3.499</td>
<td>0.652</td>
<td>3.560</td>
<td>12.283</td>
<td>3.108</td>
<td>178.066</td>
<td>0.186</td>
</tr>
<tr>
<td>Unclass.</td>
<td>8.207</td>
<td>1.878</td>
<td>3.693</td>
<td>0.639</td>
<td>3.750</td>
<td>12.414</td>
<td>3.093</td>
<td>177.209</td>
<td>0.173</td>
</tr>
</tbody>
</table>
FIGURE 4. STANDARD ELLIPSES OF THE INDUSTRIAL WORKER POPULATION, 1947-1960
manufacturing. For 1960, professionals, managers and clerical workers are the most clustered groups in the city. All other occupational groups, however, differ in their degree of dispersion except transportation, which showed a high degree of dispersion, as indicated by the standard radius of 5.396 as compared to the total population of 3,776.

Consider changes in the mean center of the major occupation groups. The industrial worker groups were close to the center of the city in 1947; they managed to move their center a distance of 1.147 miles toward the southwest. This may have coincided with the industrial expansion in this area over time. Their standard radius increased from 2.622 miles in 1947 to 3.769 in 1960. Figure 4 indicates such change. During the same period, the transportation workers' center moved out toward the southeast, due to the recent expansion of the city in that direction. Their standard radius shows a tremendous increase from 2.34 in 1947 to 5.396 in 1960. However, they have become more dispersed in 1960 than in 1947. Such a dramatic change for this group is actually explained by knowing the nature of their occupation. This is indirect support for the relationship between transportation and urban growth.

Sales and Commerce groups had been more clustered than the other occupational groups. This is measured by their low standard radius compared to the standard radius of the total population for both years. While 80% of these groups were residing within a radius of 3 miles around the center of the city in 1947, their percentage decreased to 69% in 1960.
Almost 4% of all sales and commerce groups managed to move out within a distance of 10 to 13 miles from the center of the city.

The preceding analysis, however, does not tell us much in regard to the location of status groups in space. We shall devote most of the following analysis to deal with the location of the higher occupational groups in Alexandria, compared to the lower occupational groups. This analysis, we believe, should enable us to locate the position of these groups by distance gradient from the center of the city in 1960. The analysis includes data for professional-managerial, artisan-craftsmen, and unskilled workers.

Let us, for the moment, consider the location of the higher occupational groups in Alexandria: Technical-Professionals, and Executive-Managerial. Figure 5 shows the standard ellipses for the two groups and the total population, and demonstrates that both groups live close to each other. The distance between their mean center is .66 miles; the relative standard radius also indicates that they are more clustered as compared to the total population.

The Artisans and Craftsmen group are more dispersed in their location than the higher occupational groups, as compared to the standard radius of the total population. This group lives very close to the unskilled workers with a distance of only .19 miles.

Another explanation is available for the Professionals and their distance gradient from the city center. Figure 6 shows the ellipses of the Professionals in 1960 and the percentage of distribution by distance gradients.
FIGURE 5. THE ELLIPSES OF THE PROFESSIONAL AND EXECUTIVE-MANAGERIAL GROUPS, ALEXANDRIA, 1960
FIGURE 6. THE ELLIPSES OF THE PROFESSIONAL GROUP AND THEIR PERCENTAGE DISTRIBUTION BY DISTANCE GRADIENTS, 1960
Figure 6 has been divided into 6 zones with an angle of 60° for each zone. We assigned 3 miles for each zone from the center of the Professional group toward the periphery. The findings support the idea that the higher occupational group lives close to the center of the city.

The Religious Groups

Data for 1947 through 1966 is available for comparison. In fact, the standard radius appears to be one of the pseudo-measures which provides us with a simple device for comparing the standard radius of the three major religious groups with that of the total population.

Table 23 shows a summary of centrographic measures for the major religious groups in Alexandria for 1947, 1960 and 1966. The data indicate that the Jews and Other Foreign Christians are the clustered groups in the city in the three census years. The standard radius of the Moslem population is compared with the standard radius of the total population presented in Table 21 and indicates that the two ratios are very close. Their center, however, had changed by 1.282 miles between 1947 and 1960. The Coptic population had enjoyed changing their center dramatically between 1947 and 1966. During this period they have shown a different spatial patterning; high clustering in 1947, to relative dispersion in 1960 and high clustering again in 1966.

By looking at the percentage distribution of the major religious groups by distance gradient, it has become apparent to us that the majority of all three major groups still live close to the center of the city, within a radius of 5 miles.

<table>
<thead>
<tr>
<th>Religious Groups</th>
<th>Mean Center</th>
<th>Standard Distance</th>
<th>Standard Radius</th>
<th>Angles °</th>
<th>Coefficient of Circularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jews-Others 1960</td>
<td>8.462 1.676</td>
<td>3.108 .441</td>
<td>3.050 10.484</td>
<td>0.014 172.816</td>
<td>.146</td>
</tr>
<tr>
<td>Coptics 1966</td>
<td>8.465 1.676</td>
<td>3.024 .441</td>
<td>3.056 10.850</td>
<td>0.014 177.828</td>
<td>.146</td>
</tr>
</tbody>
</table>
**FIGURE 7. THE ELLIPSES OF MUSLIMS, COPTICS, AND JEWS, ALEXANDRIA, 1947**
FIGURE 8. THE ELLIPSES OF MUSLIMS, COPTICS, AND JEWS, 1960

Center of the City
\Triangle Center of the Groups

- Jews
- Copts
- Muslims

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jews</td>
<td>8.46</td>
<td>1.67</td>
</tr>
<tr>
<td>Copts</td>
<td>8.53</td>
<td>1.87</td>
</tr>
<tr>
<td>Muslims</td>
<td>8.64</td>
<td>1.83</td>
</tr>
</tbody>
</table>
FIGURE 9. THE STANDARD ELLIPSES OF MUSLIMS, COPTICS, AND JEWS, ALEXANDRIA, 1966

Center of the City
Δ Center of the Groups
- Muslims
- Coptic
- Jews

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslims</td>
<td>8.55</td>
<td>1.87</td>
</tr>
<tr>
<td>Coptics</td>
<td>8.46</td>
<td>1.67</td>
</tr>
<tr>
<td>Jews</td>
<td>8.75</td>
<td>1.97</td>
</tr>
</tbody>
</table>

0 1 2 3 miles
A complete graphic summary of what we know about the religious groups in Alexandria is presented in Figures 7, 8, and 9.

The Educational Groups

The quality of the neighborhoods is determined by the location of the educational groups in the city. Our generalization, however, should be drawn carefully for a number of reasons. First, the percentage of illiteracy is very high in Alexandria. The literacy rate is 48% of the total population for Alexandria in 1960. Second, the educational categories as specified in the census do not, in fact, tell us very much and, in turn, would not enable us to delineate a neighborhood very precisely.

For these two reasons, we decided to locate and compare the center of the illiterates and the center of the college graduates, and to determine in what direction these centers are from the center of the city, as well as their distance gradient.

Data for 1947 and 1960 are available. Table 23 shows a summary of the centrographic measures for both groups in 1947 and 1960, and indicates that the illiterate group was also closest to the center of the city in 1947, as measured by the standard radius compared to the center of the total population. The illiterate group had the same degree of dispersion as that of the total population.

By 1960, the center of this group had moved toward the southeast due to changes in the boundaries of the city, which resulted in including

<table>
<thead>
<tr>
<th>Education Groups</th>
<th>Mean Center X</th>
<th>Mean Center Y</th>
<th>Standard Distance Major Axes</th>
<th>Standard Distance Minor Axes</th>
<th>Standard Radius Orienta. Std. Node</th>
<th>Angles° Nec. Rota.</th>
<th>Coefficient of Circularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illiterate</td>
<td>7.407</td>
<td>2.044</td>
<td>2.564</td>
<td>.674</td>
<td>2.651</td>
<td>11.193</td>
<td>3.060 175.345 .263</td>
</tr>
<tr>
<td>College Edu.</td>
<td>7.703</td>
<td>2.132</td>
<td>2.390</td>
<td>.612</td>
<td>2.467</td>
<td>11.394</td>
<td>3.066 175.669 .256</td>
</tr>
<tr>
<td>1960</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College Edu.</td>
<td>9.513</td>
<td>1.906</td>
<td>3.103</td>
<td>.508</td>
<td>3.144</td>
<td>13.587</td>
<td>3.132 179.452 .164</td>
</tr>
</tbody>
</table>
FIGURE 10. THE STANDARD ELLIPSE OF COLLEGE-EDUCATED GROUPS AND THEIR PERCENTAGE DISTRIBUTION BY DISTANCE GRADIENTS, 1960
more of the rural population in the metropolitan area.

The college-educated group has shown a change in their center toward the northeast between 1947 and 1960 and has become more clustered as compared to the total population. Figure 10 shows the movement of college-educated groups as indicated in the change in their mean center along the X and Y coordinates. This movement appears to coincide with the emerging of the new residential area in el Ram1 (Ramleh) in the northeastern section of the city.

The Foreign-Born Population

Foreigners have been attracted to the City of Alexandria for centuries. In recent times, however, the City's portion of foreign-born inhabitants has declined dramatically as discussed in Chapter III. Such decline has coincided with the political as well as the economic changes that have occurred in the Egyptian society during the last twenty years.

For our purpose we must establish the center of the foreign-born population in the City of Alexandria. Their residential pattern would indicate that they were residually segregated in 1947. Since then, there has been little change in relation to their location to the center of the city, or, in their segregation.

Table 24 shows a summary of the centrographic measures for this foreign-born element for 1947 and 1966.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Center X</th>
<th>Mean Center Y</th>
<th>Standard Distance Major Axes</th>
<th>Standard Distance Minor Axes</th>
<th>Standard Radius Std. Node</th>
<th>Angles ° Node Nec. Rota.</th>
<th>Coefficient of Circularity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1947</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreigners</td>
<td>8.046</td>
<td>2.792</td>
<td>2.871</td>
<td></td>
<td>.485</td>
<td>2.371</td>
<td>12.471</td>
</tr>
<tr>
<td>1960</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreigners</td>
<td>8.629</td>
<td>1.928</td>
<td>2.438</td>
<td></td>
<td>.491</td>
<td>2.487</td>
<td>12.481</td>
</tr>
</tbody>
</table>
Table 24 indicates that the foreign-born population used to live in a residential area quite apart from the Egyptians in 1947. This is shown by the mean center on the X and Y coordinates, which indicate a direction toward the northeast. The relative standard radius also points out clustering more than the Egyptian population.

While the Egyptians have managed to change their center toward the northeast and southeast, the data suggest that the foreigners did not change their residence over the same period. At least, those who have remained in the city from foreign-born stock did not change their place of residence. There is a slight change in their location toward the southeast. Almost 52% of the total foreign-born population lived within a radius of 2 miles from the center of the city in 1947. Only 7.5% of the total foreign-born lived in the fringe. In 1966, 43.7% lived within a radius of two miles. The reason for this relative stability of the foreign population because they had a chance to select their neighborhood. When the first generation of foreigners came to settle in Egypt, their economic position helped in their residential choice. In most cases, land for residential purposes, planned and developed by foreign companies, was located within the center of the city. This area has remained attractive to both foreigners and upper-middle class Egyptians who have the economic means to live in a convenient place.

Although the behavior of the foreigners seems to be at odds, it is, in fact, consistent with the behavior of the native population in general.
Discussion and Concluding Remarks

It has become apparent that the City of Alexandria has been experiencing expansion and growth since 1947. Movement in the mean center of the total population indicates that the city is expanding toward the Northeast and Southeast areas. In fact, these areas are the only ones in which the city can expand. No movements toward the Northwest and Southwest were observed, except for the industrial workers. No reason was suggested as to why the city has not expanded toward the West which has available land. However, the information we have indicates that the western section of the city has attracted many industries in recent decades; because of the location of the leather industry in this area, persons seem to prefer searching for other locations for their residence.

The pattern of the movements for the total population, as well as status and religious groups indicate change in the mean center, along the X and Y coordinates is toward the northeast and southeast. Unfortunately, we do not have comparable data for the higher socioeconomic groups, such as income, to trace their movement from the city's center toward the periphery. The slight changes in the relative standard radius between the professionals and the working classes (between the illiterates and the college-educated groups) might predict future movements for the higher socioeconomic groups.

Finally, no magic is claimed for the centrographic measures. However, their specific characteristics appear to play a supplementary role in our analysis.
CHAPTER VII
SUMMARY AND CONCLUSIONS

Research has been made on a cross-cultural case study of Alexandria, Egypt. The research problem was initially promoted by the following theoretical and empirical considerations:

1. The theoretical considerations stem from the need for more comparative description and analyses of urban places. Such need, in fact, has proved to have a significant role in the development of a more comprehensive theory of comparative urban ecology. Recent investigators argue that the formalization induced by factorial research might be useful in developing a scale of urban development from pre-to-post-industrial forms. To achieve this goal, the next step calls for the detailed analyses of various cities from different parts of the world which would place them on a scale of societal differentiation, or urban development. The need, therefore, is to determine the framework within which those differences systematically appear.

The current line of research implies that the city in developing societies is a class of urban phenomenon, having special characteristics which distinguish it from both the industrial city and the pre-industrial city. Few studies, however, have attempted to delineate the distinctive aspects of the class structure of the developing city; most of the findings in these studies were aimed, at most, toward pointing out that the class structure of the developing city does not
completely resemble either the class structure of a preindustrial city, or that of an industrial city. Accordingly, current ecological investigations reveal an interpenetration of preindustrial and industrial ecological components, consistent with the notion that these cities are in some transitional developmental stage.

Thus, the present study could be viewed as an attempt to extend this other cross-cultural research by offering another case study of a developing city, using enumeration district data from the 1947 and 1960 censuses of population.

2. The empirical consideration for the present study has emerged from the need to conduct research investigating the relationship between urban ecological structure and societal differentiation. Most studies, so far, have focused on only one city in a given society without giving any attention to the existing variability in pattern of the urban structure. The study of Cairo by Abu-Lughod in 1966 has been cited in the literature as an example to indicate that the degree of social differentiation in the Egyptian society is less than that in the technologically advanced countries, as is the case of the United States and Canada. The case of Alexandria, however, has questioned such generalization by pointing out that there might be many differences between the ecological structure of the two largest cities in a developing country such as Egypt.

The present study was designed to meet these theoretical and empirical considerations. A number of aggregative techniques were
called upon to deal with three major objectives:

1. The identification of the factor structures of Alexandria for 1947 and 1960, using the factor-analysis technique and the change analysis between both years.

2. The extent to which the various status groups are residentially segregated from each other.

3. The areal distribution of these status groups and their migration patterns between 1947 and 1960.

These major objectives were initially suggested to deal with two major problems:

1. To delineate the basic dimensions of the ecological structure of the City of Alexandria which underly the determinants of social differentiation and the spatial segregation of population types.

2. To demonstrate the potential usefulness of the factorial ecological approach in cross-cultural investigation.

The overall results from this study permit some statements to be made concerning factorial ecology in general, and its application to cities in developing nations. The cross-sectional analysis of the data has confirmed that there is no factorial disassociation between familism and social rank. Both family and social rank variables are reflected in the ecological pattern of Alexandria. These general
findings are consistent with Abu-Lughod’s major findings in Cairo, and contrast with the normal separation of these two sets of indicators in factor analyses of American city data matrices.

Comparison between the factor loadings on the same lists of variables for both Cairo and Alexandria supports the fact that the factor analysis has produced consistent loading patterns over the period under investigation. However, many points of ecological contrasts were observed for the two communities. Both the factor loadings on the extracted factors for the two cities and the calculated coefficients of congruence support such a conclusion. The cross comparisons between the factor loadings of the two communities support our claim that there is a difference in the factorial structure of the two cities. This has theoretical significance; it implies the variability in the ecological dimensions, especially in those societies which are characterized with a moderate degree of societal development.

The factor loadings on the socioeconomic factor for the two communities indicate differences in the defining variables. The loadings on Factor I indicate that the loadings on Variable 12 (Percentage of Muslims living in each tract) are high for Alexandria, compared to relatively low factor loadings for Cairo. In addition, the second marked contrast in the loadings shown by Variable 5 (Females Divorced) which show a positive loading with socioeconomic rank in Cairo and a very insignificant loading for Alexandria. However, the overall factor loadings on the socioeconomic factor for both cities indicate that residential stability is associated with the higher socioeconomic status.
Factor II, or the social disorganizational dimension, shows some contrasts between the two cities. While Factor II is highly defined by the Handicapped ratio and Demographic density for Cairo, the same factor shows relatively high loadings on Male Unemployment, Females Divorced, and Muslims. Ethnicity, as it pertains to the Muslim population in Alexandria enters into the ecological structure of Cairo quite differently. However, most disorganized areas in both Cairo and Alexandria are spatially located in the inner city slums, as well as in the outskirts, which function as accommodations for rural migrants.

Loadings on Factor III also show some ecological contrasts between the two cities. This factor was identified as a "male dominance" factor. While such identification might be true for Cairo, it does not seem to be for Alexandria. The special character of this factor in Alexandria emerges when we observe the high factor loadings on Females Divorced. This would suggest that this factor is a "female dominance" factor in Alexandria.

The cross-sectional analysis of the data, using factor analysis, provides us with a static description of the underlying ecological dimensions of the city; to investigate the underlying dimensions of change between 1947 and 1960, a change analysis model was employed. All of the studies which have employed the social area change analysis have attempted to examine the spatial patterning of social area indexes which vary systematically over time. The analysis of social area change in Alexandria, however, is not directed toward this aim of providing the relative position of such a city on the scale of societal development.
A factor analysis with a Varimax rotation was performed and three factors were extracted. The extracted dimensions clearly indicate some increasing variability in the ecological structure of the city which the cross-sectional examination failed to predict. Two kinds of changes were outlined: variability in family type, and variability in the social status factor. Such a conclusion should not be taken for granted however, until an extensive analysis is made of the "necessary conditions" needed for the factorial separation among the basic ecological dimensions of the city.

In fact, the heart of the present study is contained in Chapter IV. The general findings in this chapter support the fact that the use of factor analysis as a model of ecological structure provides an optimal method for systematic intra-national comparisons of the fundamental dimensions of residential area differentiation in urban and metropolitan communities.

Our findings also reveal the spatial patterning of residential location for the major status and religious groups. The findings support the fact that there is a difference in the residential distribution of social groups in the city. If increasing social distance is paralleled by increasing dissimilarity in residential location, we can argue, then, that the findings support this argument. Our findings, however, do not completely support the pattern of centralization among status groups, which is typical to that of modernizing cities, with the highest status groups most centralized and the lower status groups
the most decentralized. The findings indicate, for example, that the highest occupational groups are decentralized and the middle and lower occupational groups are centralized. This might reveal the stage of development of Alexandria, which has experienced rapid growth and development in recent years.

The differences in residential distribution for the major religious groups suggest that religion is one of the factors which underlie the residential patterning among social groups in the city.

The analysis in Chapter VI enabled us to depict the aggregate social structure of the city. The use of centrographic measures provided us with a clear mapping of our data. The focus of Chapter VI was to apply a set of centrographic measures to locate the major status and religious groups and to indicate their relationships to each other in space over time. The information yielded by the measures, in fact, do play a supplementary role in our analysis.

The foregoing observations indicate clearly that the ecological structure of the City of Alexandria is undergoing a significant change. While the present ecological configuration of the city does not completely resemble that of technologically advanced cities, there is some evidence to suggest that the ecological structure of the city will evolve a pattern similar to the Western configuration. This could be achieved along with developments in industrialization, transportation, and communication.
Suggestions for Further Research

Some limitations can be observed in the present study. This study is by no means a direct test of the theory of increase in societal scale. To test the assumption that the social characteristics of cities can be inferred from those of the social systems within which they are located, a longitudinal examination of the data should be performed. An historical analysis seems to be important for general assumptions of the theory which indicate that as a society increases in scale, its subareas become more functionally specialized and differentiated.

The present study, however, is of a cross-sectional nature. The lack of longitudinal data available in the census bulletins for the city does not permit such a test. Next year it would be possible to conduct an historical examination of the temporal structure of the city by using subarea data for three consecutive census years, 1947, 1960 and 1970.

Another limitation appears after the completion of the final analysis. This limitation is in relation to the employed set of variables which are related to the ecological and demographic structure of the city. The selected variables for the final analysis were confined to thirteen variables. No argument, therefore, is presented that these thirteen indicators of demographic and socioeconomic characteristics are the best measures, or the only ones that could be devised. Two other demographic variables, however, could be suggested which would
have significant implications upon our findings:

1. A density gradient variable which would indicate whether or not Alexandria has experienced a decrease in the density gradient between 1947 and 1966. Our summation in relation to the density of population in the city is very general and should be taken as a tentative conclusion. This demographic variable could have been devised easily from census-tract data with relation to the distance from the city's center.

2. A familism gradient variable which would clearly show the distribution of percentages of families, or the number of households, from the center of the city to the periphery. This would clearly have shown the dominant residential area, which is a direct indicator of the city's land-use pattern.

Our analysis of the variation in residential patterns of status groups suggests another limitation. Data on income is not available in the Egyptian census. Our investigation of the spatial location of the highest status groups is confined to information based on occupation and education. While we would expect that the income categories would reveal a similar residential pattern as that revealed by the other two status variables—occupation and education—income has proved to be the most sensitive indicator of residential selection in most cities.

The limitations outlined in this chapter do in fact stimulate further inquiry. Such an investigation would deal with the determinants of social differentiation of urban populations in the Egyptian society. We suggest that further investigations should be directed
toward a more specific analysis of social change within the Egyptian society.

Since the level of modernization of a nation is reflected in the degree of differences between the primary and secondary cities in urban patterns, we suggest that both Cairo and Alexandria should be studied in relation to other middle-sized cities within the same society before generalizations are made about the level of the social scale. Such an investigation would be of some importance to the development of a general theory of comparative urban ecology. This will not be achieved, however, until a rigorous effort has been made to devise more quantitative measures of the level of societal modernization as is reflected in the degree of complexity in the social organization, the occupational structure, and the productive systems.
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UNPUBLISHED MATERIAL


